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ENGINEERING STUDENTS' PERCEPTION OF MINITAB IN LEARNING STATISTICS

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ABSTRACT

The integration of statistical software in engineering education has become essential for bridging the gap between theoretical concepts and practical applications. This study examines the effectiveness of Minitab software in enhancing students' understanding of statistical concepts in the STA408 course at Universiti Teknologi MARA (UiTM) Penang. A survey was conducted among 26 engineering students from various disciplines, assessing their perceptions of Minitab's usability, impact on learning outcomes, and relevance to future careers. Descriptive statistical analysis revealed that students generally had a positive experience with Minitab, particularly appreciating its visualisation features for interpreting statistical outputs. The findings suggest that incorporating Minitab into statistics courses promotes active learning, improves problem-solving skills, and enhances confidence in statistical analysis. As industries increasingly rely on data-driven decision-making, equipping engineering students with proficiency in statistical tools like Minitab is crucial for their academic and professional development.

Keywords: Statistics, Minitab Software, Engineering Students

Introduction

In the field of engineering education, the integration of statistical software into the curriculum has become increasingly prevalent. This tool is designed to enhance students' understanding of complex statistical concepts by providing hands-on experience. Minitab, in particular, has been widely adopted because of its user-friendly interface and robust analysis capabilities. Its application spans a variety of educational settings, aiming to bridge the gap between theoretical knowledge and practical application.

Recent studies have explored the effectiveness of incorporating Minitab into statistics education. For example, research conducted by Mairing (2020) examined the combined use of Minitab and Excel in an advanced statistics course. Research findings suggest that relying solely on one software is less effective in improving the learning outcomes of undergraduate students. On the other hand, an integrated approach, coupled with collaborative teaching methods, significantly improves student achievement in statistics learning.

In addition, Minitab's role in facilitating the understanding of statistical concepts has become a topic of discussion among educators. Eales and Stander (2009) highlight the software's ability to assist in teaching statistics in higher education. They emphasise that Minitab's intuitive design and

comprehensive features make it a valuable resource for both instructors and students, promoting a deeper understanding of statistical methodology.

Further investigations have shown the practical benefits of Minitab in educational settings. A study by Ramesh (2009) details how Minitab improves student learning in undergraduate mathematics and statistics programs. Research shows that software helps in developing statistical thinking and provides students with essential skills to perform statistical analysis.

Moreover, the evolution of Minitab has been noted for its impact on statistics education. Software development over the years has simplified the teaching and learning process, making statistical analysis more accessible to students. These developments have played an important role in transforming statistics from a theoretical subject to a practical and application-orientated discipline (Oldknow et al., 2010).

The integration of Minitab into the statistics curriculum has also been associated with improved student engagement. By providing a hands-on approach to data analysis, Minitab encourages active learning and helps students visualise complex statistical concepts, thereby improving overall understanding and retention of material (Okagbue et al., 2021).

Furthermore, the use of Minitab in teaching statistics is in line with the goal of modern education to equip students with practical skills relevant to their future careers. As industries increasingly rely on data-driven decision-making, proficiency in statistical software such as Minitab is an essential competency for engineering graduates (Setambah et al., 2019).

In summary, the incorporation of Minitab into engineering statistics courses has been shown to improve student learning outcomes, foster engagement, and provide practical skills that can be used in professional contexts. These findings emphasise the value of integrating user-friendly statistical software into educational programs to bridge the gap between theory and practice (Alqudah et al., 2024).

Materials and Methods

Research Design and Study Procedure

This data set consists of responses from 26 engineering students from Universiti Teknologi MARA (UiTM) Penang, who have used Minitab in the Statistics for Science and Engineering (STA408) course. Among the respondents, there were 8 female students and 18 male students. The data provided insight into their perceptions of Minitab's effectiveness in improving their understanding of statistical concepts.

The STA408 course, as discussed by Shaziayani et al. (2024), plays an important role in equipping engineering students with important statistical knowledge and analytical skills. This course provides a solid foundation in data analysis, hypothesis testing, and statistical software applications, making it particularly beneficial for students pursuing careers in engineering and data-driven fields. Given its hands-on approach and integration of tools like Minitab, STA408 is a valuable course that

students should consider to improve their problem-solving abilities and decision-making skills in real-world scenarios.

Survey Design and Data Collection

This study aims to explore students' opinions on the use of Minitab software in learning statistical concepts at Universiti Teknologi MARA (UiTM) Penang Branch. A structured questionnaire was used to collect data, which consisted of two main parts: (1) personal information, including gender, faculty (electrical, mechanical, chemical and civil engineering) and age, and (2) students' perceptions of the Minitab software, focusing on its effectiveness in improving their understanding of statistics. Responses were collected anonymously, and all data were anonymised to ensure privacy and reliability.

As shown in Table 1, the questionnaire included 20 questions with a five-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree) designed to measure students' perceptions of the usability, effectiveness, and impact of Minitab on their statistics learning experience. These questions include aspects such as confidence in performing statistical analysis, ease of use, and the role of software in improving problem-solving skills. The collected data were analysed using descriptive statistics to evaluate the overall effectiveness of Minitab in the STA408 course.

Table 1. Lists of Questions and the Items Coding

Questions	**Item Coding**
I am confident in my ability to perform statistical analyses.	VAR1
I am confident in interpreting statistical outputs from software tools.	VAR2
I have had a positive experience using Minitab.	VAR3
I found Minitab easy to learn and use.	VAR4
I frequently used Minitab for my assignments and projects.	VAR5
I am confident in my ability to perform statistical analyses after using Minitab.	VAR6
I can apply the statistical knowledge I gained to real-world scenarios effectively.	VAR7
I find Minitab useful for my future studies or career.	VAR8
Using Minitab increased my interest in statistics.	VAR9
Using Minitab has improved my understanding of statistical methods.	VAR10
I feel more confident in exploring complex datasets after using Minitab.	VAR11
Minitab provided useful visualizations that helped me understand statistical outputs better.	VAR12
I find Minitab to be a valuable tool for enhancing my statistical analysis skills.	VAR13

My ability to solve statistical problems has improved through my experience with Minitab.	VAR14
I feel more prepared to tackle advanced statistical topics after using Minitab.	VAR15
Using Minitab has increased my efficiency in performing statistical analyses.	VAR16
Minitab's user-friendly interface made learning statistics more enjoyable for me.	VAR17
I believe my career prospects in data analysis or related fields have improved through my experience with Minitab.	VAR18
I am confident in teaching others how to use Minitab for statistical analyses.	VAR19
I feel that Minitab has helped me grasp statistical concepts more quickly than other tools.	VAR20

Descriptive Statistics

The bar chart in Figure 1 depicts the age distribution of the students who participated in the study. The majority of respondents (65.4%) were 23 years old, making this the most common age group. A small number of students, 11.5%, are 22 years old, while 7.7% of respondents are 20 and 24 years old, respectively. Additionally, a minimum number of students aged 26 and 27, respectively representing 3.8% of the total, participated in the survey. This distribution shows that most students are within the typical university age range for undergraduate studies.

The data showed that the students surveyed were mostly in their early twenties, perhaps in their third or fourth year of study. The relatively low number of students aged 26 and 27 indicates that mature students or those pursuing postgraduate studies are not significantly represented in the survey. This distribution is helpful in understanding the demographics of typical students who engage with Minitab software in their statistics coursework.

While the pie chart in Figure 2 presents the distribution of students according to their respective engineering faculties at UiTM Pulau Pinang. The largest group, 42.3% of respondents, belonged to PPKK (Chemical Engineering), which is 11 students. PPKM (Mechanical Engineering) follows closely, comprising 34.6% of students. Meanwhile, PPKA (Civil Engineering) represented 19.2% of participants, and PPKE (Electrical Engineering) accounted for the smallest share of 3.8%, which is 1 student only.

This distribution shows that the majority of students who use Minitab in their coursework come from chemical and mechanical engineering backgrounds. Civil and Electrical Engineering students also participated but in smaller numbers, suggesting fewer students from these faculties were available for this study.

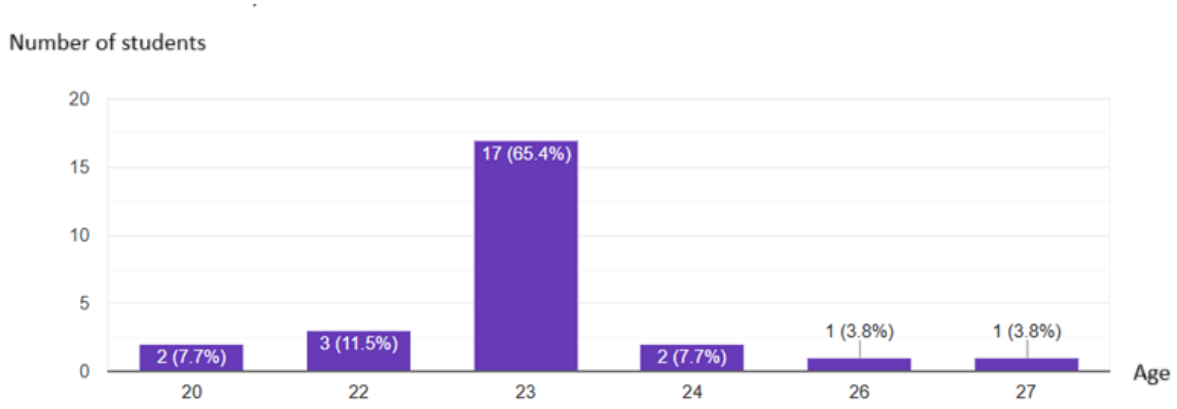

Figure 1. Age Distribution of Students

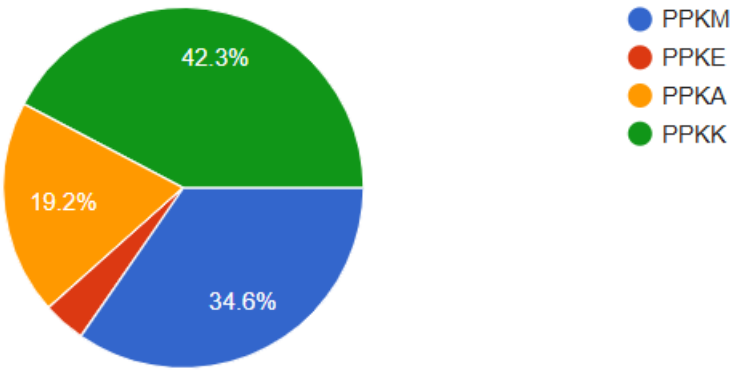

Figure 2. Distribution of Engineering Students by Faculty at UiTM Penang

Furthermore, Table 2 showed the descriptive statistics of students' perceptions regarding the effectiveness of Minitab software in learning statistical concepts in the STA408 (Statistics for Science and Engineering) course at UiTM Penang. The table summarizes the minimum, maximum, mean, standard deviation, and skewness values for 20 different perception-based questions, which were measured on a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The mean scores range from 3.92 to 4.24, indicating generally positive student perceptions of Minitab's role in improving their statistical understanding. The standard deviation values range from 0.759 to 0.909, suggesting some variation in students' responses.

From the table, the highest mean score (4.24) is recorded for VAR12, which suggests that students found Minitab's visualizations particularly useful in understanding statistical outputs. Other high-scoring variables, such as VAR3, VAR9, VAR10, VAR14, and VAR18 (mean = 4.16), indicate that students generally had a positive experience with Minitab, found it effective in increasing their

interest in statistics, and believed it improved their problem-solving skills. Meanwhile, the lowest mean score (3.92) for VAR1 and VAR5 suggests that while students were fairly confident in their ability to perform statistical analyses, they may not have used Minitab as frequently for assignments and projects.

The skewness values range from -0.354 to -0.913, indicating a negatively skewed distribution for all variables. This suggests that most students responded with agreement or strong agreement regarding Minitab's effectiveness. However, variables with relatively lower skewness (e.g., VAR1 and VAR5) indicate a more balanced spread of responses, suggesting that some students might have been neutral or disagreed regarding their confidence in performing statistical analyses. Overall, these findings highlight that students perceive Minitab as a valuable tool for learning statistics, reinforcing its role in enhancing their statistical knowledge and practical skills.

Table 2. Descriptive Statistics of Students' Perceptions on the Use of Minitab in STA408

Variable	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**	**Skewness**	
					Statistics	**Standard Error**
VAR1	2	5	3.92	0.812	-0.354	0.464
VAR2	2	5	4.12	0.781	-0.79	0.464
VAR3	2	5	4.16	0.8	-0.838	0.464
VAR4	2	5	4.08	0.862	-0.586	0.464
VAR5	2	5	3.92	0.909	-0.556	0.464
VAR6	2	5	4.12	0.781	-0.79	0.464
VAR7	2	5	4.12	0.833	-0.709	0.464
VAR8	2	5	4.08	0.909	-0.529	0.464
VAR9	2	5	4.16	0.8	-0.838	0.464
VAR10	2	5	4.16	0.8	-0.838	0.464
VAR11	2	5	4.08	0.759	-0.759	0.464
VAR12	2	5	4.24	0.879	-0.913	0.464
VAR13	2	5	4.2	0.816	-0.899	0.464
VAR14	2	5	4.16	0.85	-0.768	0.464
VAR15	2	5	4.12	0.833	-0.709	0.464
VAR16	2	5	4.2	0.816	-0.899	0.464
VAR17	2	5	4.12	0.781	-0.79	0.464
VAR18	2	5	4.16	0.898	-0.712	0.464
VAR19	2	5	4.08	0.759	-0.759	0.464
VAR20	2	5	4.08	0.812	-0.66	0.464

Conclusion

This study highlights the positive impact of integrating Minitab software into the STA408 course, demonstrating its effectiveness in improving students' statistical understanding, engagement, and analytical proficiency. The findings suggest that Minitab's user-friendly interface and robust analytical tools enhance learning experiences by facilitating hands-on data analysis, fostering self-regulated learning, and preparing students for data-driven decision-making in their future careers. As engineering education evolves, incorporating advanced statistical software into curricula will continue to play a pivotal role in equipping students with essential skills for professional success.

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