
STUDENTS' PERCEPTIONS OF THE ENGINEERING MATHEMATICS 2 COURSE REINFORCEMENT WORKSHOP AT POLITEKNIK IBRAHIM SULTAN

Zainab Binti Ali Taha¹, Wan Hamiza Binti Wan Hasan², Suhana Binti Abdul Aziz³

^{1,2,3} Department of Mathematics, Science and Computer, Polytechnic Ibrahim Sultan, Pasir Gudang, Johor, Malaysia
E-mail: zainab@pis.edu.my, wanhamiza@pis.edu.my, suhana@pis.edu.my

Abstract

Engineering Mathematics 2 is one of the courses offered to students taking Electrical Engineering Diploma (JKE) and Mechanical Engineering Diploma (JKM) at Politeknik Ibrahim Sultan. However, students fail the Engineering Mathematics 2 (DBM 20023) course every semester. The failure rate in this Mathematics 2 course is higher than in other courses. This study aimed to identify students' perceptions of the Mathematics Reinforcement Workshop as an initiative to improve student achievement in the Engineering Mathematics 2 (DBM 20023) course. A questionnaire (Google Form) was used as a research instrument. This study's sample size was 180 students who took the Engineering Mathematics 2 course in session 2 of 2023/2024. This study uses descriptive statistics (frequency, percentage, mean score, and standard deviation) to measure students' perceptions of the Mathematics Reinforcement Workshop as an initiative to improve the achievement of DBM 20023 course. Data was analyzed using SPSS software. The findings of this study show that the respondents agree and give a positive perception towards implementing the Reinforcement Workshop for Engineering Mathematics course 2 (DBM 20023). Positive feedback on the speakers, program implementation, and the program's impact on the overall high level of satisfaction among participants demonstrate that the program was well implemented and beneficial. The highest score which is "The speaker was able to deliver the course well" contributed to the highest mean score of 3.50, followed by item A1 " This program exposed students to techniques for answering the Final Examination." with a mean score of 3.45, and the third item with the highest mean score is item B3 " The allocated time was appropriate" with 3.44. The lowest mean score value is on item A3, which is " This program helped me feel more confident in answering Final Examination questions." With 3.35. The Mathematics Reinforcement Workshop for the DBM 20023 course for session 2 2023/2024 had a positive effect on the graduation achievement of students who took Engineering Mathematics 2 a total of 355 students (93.4%) passed and 25 students (6.6%) failed. The percentage of student failure decreased compared to semester 1 2023/2024. Therefore, this Mathematics Reinforcement Workshop can be used as an alternative by Mathematics lecturers as an effective teaching and learning reinforcement activity for students who have a weak level of mathematics proficiency

Keywords : *Mathematics Reinforcement Workshop; Engineering Mathematics 2 ;student*

I. INTRODUCTION

Mathematics is one of the courses that are deemed vital in the educational curriculum. It is crucial not only for academic knowledge but also for practical use in everyday life and numerous career domains. Mathematics is one of the disciplines that students deem difficult, which can cause low academic performance and a drop in interest in the subject [1]. However, many students face difficulties in understanding mathematical concepts, which can lead to low academic performance and decreased interest in the subject.

Mathematics Reinforcement Workshops have been introduced as one of the interventions to help students overcome challenges in mathematics learning. The use of Reinforcement Workshops in teaching mathematics has been proven to improve student performance significantly [2]. Interactive learning activities in Reinforcement Workshops can help students understand mathematical concepts more deeply [3]. The cooperative learning activities in mathematics Reinforcement Workshops can significantly improve students' mathematical skills [4]. Reinforcement Workshops that involve collaborative activities can increase student motivation in learning mathematics [5].

Mathematics course is a basic core course that students must pass to complete their diploma. There are three (3) types of Mathematics courses offered to the Electrical Engineering Department (JKE) and Mechanical Engineering Department (JKM) students: Engineering Mathematics 1, Engineering Mathematics 2, and Engineering Mathematics 3 for JKM students, and Electrical Engineering Mathematics for JKE students. All the topics taught in these Mathematics courses are a continuation of the learning at the secondary school level through the core Mathematics subject and the Additional Mathematics elective subject.

However, student failure in the Engineering Mathematics 2 (DBM 20023) course occurs every semester. The failure rate in this Mathematics 2 course is higher compared to other courses. This significantly contributes to the overall performance of individuals and the polytechnic. Based on the examination results of semester 2, 2022/2023, there are still some students who fail and repeat the Engineering Mathematics 2 course every semester. Therefore, Mathematics Reinforcement Workshop has been introduced as one of the intervention to help students overcome challenges in learning mathematics. This study aims to examine students' perceptions of the effectiveness of the Mathematics Reinforcement Workshop in helping them master this course and improve their academic performance in the Engineering Mathematics 2 course.

A. Problem Statement

The achievement of a pass rate of not less than 95% for all courses each semester is the academic

excellence KPI for the Department of Mathematics, Science, and Computer (JMSK), Politeknik Ibrahim Sultan (PIS). Based on Table 1, shows the trend of the pass percentage for the Engineering Mathematics 2 (DBM 20023) course at JMSK PIS for two consecutive semesters, starting from Session 2 2022/2023 and Session 1 2023/2024. There are still a percentage of students who failed and repeat Engineering Mathematics 2 courses each semester and caused the KPI department's target not to be achieved.

Table 1 Trend of Passing Percentage for the Engineering Mathematics Course 2 (DBM 20023) For Two (2) Consecutive Semesters Beginning with Session 2 2022/2023 and Session 1 2023/2024.

Semester	% Pass	% Fail
2 2022/2023	75.3	24.7

1 2023/2024	74.5	25.5
-------------	------	------

Several factors were identified as causes of student failure in the Engineering Mathematics 2 course (DBM 20023) based on observations. Students who learn the theoretical ideas of mathematical formulas perfectly may nevertheless make errors in computations because they are less competent at using calculators. Students do not give the right responses because they are confused about how to employ mathematical formulas. Students do not review or practice outside of class hours to learn well. Self-training is required since the mathematical formula utilized remains constant, although the number and form of the question fluctuate.

Therefore, the Mathematics Reinforcement Workshop was proposed by the Engineering Mathematics 2 Course Coordinator to the Head of the JMSK Department. This seminar aims to help students effectively master the topics they have learned by providing space and opportunities for small-batch exercises and discussions with facilitators, emphasizing the use of formulas as answering guides, improving answering skills, and further improving the passing rate of grades B and above, thereby enhancing the knowledge and understanding of students participating in the DBM 20023 course. The Mathematics Reinforcement Workshop is an initiative to enhance Continuous Quality Improvement (CQI) for the Engineering Mathematics 2 (DBM 20023) course based on the examination achievement findings for the DBM 20023 course in Session 2 2022/2023 and Session 1 2023/2024.

II. LITERATURE REVIEW

To ensure that students achieve outstanding exam scores, a variety of tactics and approaches are used. Lecturers' roles are to help students grasp and master the material being taught. As a result, various strategies can be employed to ensure that students quickly learn and master the topics presented by the lecturer, as well as answer the evaluation questions correctly and achieve good results. A variety of techniques and methods in answering the exam help students improve their understanding and obtain high marks in the final exam. A study found that workshops focused on lectures and tutorials improved student achievement compared to conventional techniques [6].

A study found that educators must use effective approaches to engage and encourage pupils to learn [7]. While a study found that the question answering approach Workshop method can assist students

perform well on the final examination [8]. This is supported by a study which found that Reinforcement Workshops increase student exam performance [9]. The students who attended Reinforcement Workshops achieved better results based on the assessments that had been made [10]. Several other research have indicated that teachers' learning approaches should be consistent so that students may understand the subjects taught and perform well in them [11], [12], [13].

According to previous studies, faults or neglect in Mathematics that are frequently detected include solving the work using the improper technique or formula[14], students forgetting the Mathematical formula connected to the question being addressed [15], Students do not fully understand the concept of mathematical formulas, which leads to errors in solving mathematical operations[16] students struggle to solve various calculation operation questions[17], and students are careless in solving mathematical problems as a result of rushing to answer questions [18].

Therefore, based on previous studies, implementing the Engineering Mathematics 2 Reinforcement Workshop is very important for students to improve their understanding of this course. This Workshop provides problem-solving methods and techniques for answering questions correctly according to the questions' requirements. Apart from that, students also need to master the concept of calculation and increase the number of exercises.

A. Objective

This study was conducted to identify students' perceptions of the Mathematics Reinforcement Workshop as an initiative to improve student achievement in the Engineering Mathematics 2 course (DBM 20023).

III. RESEARCH METHODOLOGY

The study method was designed involving study design, study population and sample, study instruments and data analysis methods. The study was conducted at Mathematics, Science and Computer Department, Politeknik Ibrahim Sultan.

A. Research Design

The research process includes the collection and analysis of quantitative data. The goal of this Workshop is to teach students how to answer exam questions face-to-face in order to improve their passing rate for the Engineering Mathematics 2 course (DBM 20023). This class focuses on past final exam questions to help students become more familiar with the format of the questions, techniques, and how to answer final exams. Following the session, students were given a 'Google form' to fill out the program feedback survey. The questionnaire analysis yielded the mean score of students' perceptions of the Mathematics Reinforcement Workshop as initiative to improve achievement in the Engineering Mathematics 2 course.

According to the memo on the Determination of Passing Marks of Continuous Assessment, Final Assessment, and Final Examination for Polytechnic and Community College Study Programs dated February 10, 2023, the passing grade for the Final Exam is 20%.

The workshop is held in the last week of the lecture before the final exam begins. Students taking the DBM20023 course are the identified target group (sample) who need to attend the Math Reinforcement Workshop to help obtain the Final Exam passing grade for the DBM20023 course at the end of the semester. The model for this study can be expressed as the following Figure 1:

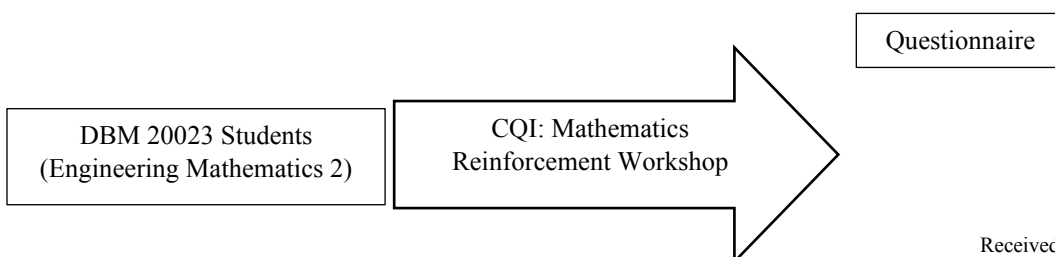


Figure 1: Relationship Model DBM 20023 Student and Questionnaire

*CQI - Continuous Quality Improvement

B. Population and Study Sample

The study sample is made up of study participants chosen to represent a specific population. Determining the research population is critical in the study since it influences how and how many samples we will select for data sources. In this study, the researcher used a random sample selection since it ensures that all students have an equal chance of being chosen as part of the study. The population of this study consisted of 380 students who took the Engineering Mathematics 2 course (DBM 20023) for Session 2 2023/2024. The sample size is based on the total population [19]. Therefore, the total sample taken in this study is 180 people.

C. Research Instruments

The study items are as shown in Tables 1 2 and 3 which are adapted. The set of questionnaires provided consists of two parts, namely Part A, which contains respondent demographic items such as the name, gender and program of study while Part B contains 10 study items which consist of various scopes of items to get feedback from students about the reinforcement workshop attended. The Likert scale used is:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Agree
- 4 = Strongly Agree

A four-point Likert scale was chosen for its ease of management and usage, as well as the items' ease of response. The Likert scale provides more reliable data than other scales such as Thurstone and Guttman [20]

Table 2 Item A (IMPACT OF THE PROGRAM)

Item code	Study Item
A1	This program exposed students to techniques for answering the Final Examination.

A2	This program guided students on how to answer Final Examination questions correctly and easily.
A3	This program helped me feel more confident in answering Final Examination questions.
A4	My level of knowledge and understanding increased.

Table 3 Item B (PROGRAM IMPLEMENTATION)

Item code	Study Item
B1	The program venue and atmosphere were appropriate.
B2	The planning and implementation of the program were smooth.
B3	The allocated time was appropriate.

Table 4 Item C (SPEAKER EVALUATION)

Item code	Study Item
C1	The speaker was able to deliver the course well.
C2	The speaker allowed participants to ask questions.
C3	The speaker helped solve the problems I faced (related to the course).

D. Data Analysis method

The entire data set is then evaluated using descriptive analysis with SPSS software version 20. The determination of levels in the analysis of research items will be measured based on the mean score value, as stated in Table 5 [21]. Only mean scores greater than 4.00 will be considered high. The demographic questions only contain numbers and percentages.

Table 5 Level determination based on the mean score

Mean Score	Interpretation
1.00 -2.00	Low/Negative

2.01-3.00	Moderate
3.01-4.00	High/Positive

Mechanical Engineering, specifically DKM, DEM, DMB, and DTP, with 61 respondents (46.2%).

Further analysis is carried out, and the products' reliability must be tested. Table 6 shows the Cronbach's alpha reliability coefficient, which is used to determine the dependability of the instrument's items. The analysis results showed that all ten items may be tested for reliability with Cronbach's Alpha values better than 0.70, which is 0.987, as shown in Table 7. As a result, all items meet the criteria for further evaluation.

Table 6 Reliability values of items

Cronbach's Alpha	Strength of Reliability
$\alpha \geq 0.9$	The Best
$0.9 \geq \alpha \geq 0.8$	Very Good
$0.8 \geq \alpha \geq 0.7$	Good
$0.7 \geq \alpha \geq 0.6$	Moderate
$0.6 \geq \alpha$	Weak

Table 7 Results of item reliability analysis

Cronbach's Alpha value	Number of items
0.987	10

IV. RESULT AND DISCUSSION

A. Demographics of the Study Sample

A total of 180 students responded. The demographic information gathered from respondents was studied using descriptive statistical analysis, which included frequency and percentage distribution. This demographic data includes gender and program. Table 7 shows that 83 (46.1%) of the 180 responders were male students. While there are 97 female students (53.9%).

Table 8 Distribution of Respondents by gender

GENDER	FREQUENCY	PERCENTAGE (%)
Male	83	46.1
Female	97	53.9
Jumlah	180	100

Table 9 shows the number and percentage of respondents in each department based on the program. The Department of Electrical Engineering, specifically DEE, DJK, and DEP, with a total of 71 respondents (53.8%), and the Department of

Table 9 Distribution of Respondents by Program

PROGRAM	NUMBER	PERCENTAGE (%)
DEE	48	26.7
DJK	18	10
DEP	21	11.7
DKM	30	16.7
DEM	25	13.9
DMB	19	10.5
DTP	19	10.5
TOTAL	180	100

B. Analysis of study items

Table 10 shows the findings of the mean score analysis for the ten (10) research items. Item C1 "The speaker was able to deliver the course well" contributed to the highest mean score of 3.50, followed by item A1 " This program exposed students to techniques for answering the Final Examination." with a mean score of 3.45, and the third item with the highest mean score is item B3 " The allocated time was appropriate" with 3.44. The lowest mean score value is on item A3, which is " This program helped me feel more confident in answering Final Examination questions.". Table 4 shows how the mean score value is used to establish the level of tendency.

Table 10 Analysis of Study Items.

ITEMS	MEAN	STANDARD DEVIATION	LEVEL
A1	3.45	0.985²	High/Positive

A2	3.40	0.928	High/Positive
A3	3.35	0.921⁴	High/Positive
A4	3.40	0.941	High/Positive
B1	3.38	0.899	High/Positive
B2	3.41	0.972	High/Positive
B3	3.44	0.978³	High/Positive
C1	3.50	0.972¹	High/Positive
C2	3.42	0.957	High/Positive
C3	3.41	0.899	High/Positive

Table 11 shows the results in the form of percentages obtained: 355 students (93.4%) passed, and 25 students (6.6%) failed for Semester 2 Session 2023/2024 that received technical assistance to answer current final exam questions Mathematics Reinforcement Workshop.

Table 11 Achievement Analysis of Students who took the DBM 20023 course for Session 2 2023/2024

PASS (%)	FAIL (%)	TOTAL
93.4	6.6	100

V. CONCLUSION

This study was conducted to identify students' perceptions of the Reinforcement Workshop for Engineering Mathematics 2 course (DBM 20023). Based on the study's findings, it can be concluded that the Reinforcement Workshop was successful in exposing students to techniques and how to answer final exam questions, providing clear and practical guidance, and increasing student confidence. Positive feedback on the speakers, program implementation, and the program's impact on the overall high level of satisfaction among participants demonstrate that the program was well implemented and beneficial. The Mathematics Reinforcement Workshop for the DBM 20023 course for session 2 2023/2024 improves the students' performance of

Engineering Mathematics 2 students. The student failure rate fell compared to semester 1 2023/2024. If students have a low level of mathematics learning, this Reinforcement Workshop can be used as effective teaching and learning reinforcement activity instead of typical mathematics lectures. It is supported that the implementation of Math workshops is recommended and more effective to enable students to better understand the learning of Mathematics[22].

At the polytechnic level, the Reinforcement Workshop for the Engineering Mathematics 2 course (DBM 20023) specifically contributed to the achievement of the Politeknik Ibrahim Sultan Strategic Plan under Core 1: Producing Quality Graduates, which entails developing very effective graduate marketability programs. Recognizing the growing potential for strengthening mathematics in the workplace, the institution's academic management is responsible for improving teaching techniques, encouraging students, increasing training, and developing close relationships between lecturers and students. To achieve this purpose, programs/activities for students must incorporate student-centered concepts, interactive learning, formative implementation before actual assessment, and so on to have an impact on polytechnic students' performance.

ACKNOWLEDGMENT

We wish to thank the respondents involved in this research due to their willingness to spend their time in answering the questionnaire. In addition, thank you for the encouragement given by institutions in producing research paper. This has become our motivation as academicians to creatively thinking about teaching approach to be employed in teaching the current generation.

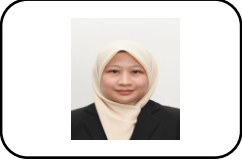

REFERENCES

- [1] S. Chand, K. Chaudhary, A. Prasad, and V. Chand, "Perceived causes of students' poor performance in mathematics: a case study at BA and Tavua Secondary Schools," *Frontiers in Applied Mathematics and Statistics*, vol. 7, Apr. 2021, doi: 10.3389/fams.2021.614408.
- [2] Ahmad, M., & Harun, Z, "Keberkesanan Bengkel Pengukuhan Matematik". *Jurnal Pendidikan Matematik*, vol. 15, no. 2 pp. 45-60, 2020.

- [3] Smith, J., "Effective Mathematics Workshops". *Pearson Education*, 2018
- [4] M. Orsoni, A. Pögel, N. Duong-Trung, M. Benassi, M. Kravcik, and M. Grützmüller, "Recommending mathematical tasks based on reinforcement learning and item response theory," in *Lecture notes in computer science*, 2023, pp. 16–28. doi: 10.1007/978-3-031-32883-1_2.
- [5] Johnson, R., & Lee, "Collaborative Learning in Mathematics Reinforcement Workshops," *International Journal of Educational Research*, vol. 35 no. 4, pp. 112-123, 2017.
- [6] Baird, K. M., & Narayanan, V., "The effect of a change in teaching structure on student performance" *Asian Review of Accounting*, vol. 18, no.2, pp. 148-161, 2010.
- [7] Kucharčíková, A., Ďurišová, M., & Tokarčíková, E., "The role plays implementation in teaching macroeconomics," *Procedia-Social and Behavioral Sciences*, vol. 174, pp. 2489-2496, 2015.
- [8] Kannan, B., Pillai, R. V., & Kunhikannan, S. K., "Keberkesanan Pelaksanaan Bengkel Pentaksiran Bilik Darjah," *Jurnal Penyelidikan Dedikasi*, vol. 19, bil.1, pp. 51-72, 2021.
- [9] Sabtu, M., & Ainuddin, N. F., "Keberkesanan Bengkel Pengukuhan Matematik Sebagai Inisiatif Meningkatkan Pencapaian Kursus Matematik Di Kalangan Pelajar Politeknik Kuala Terengganu," *International Journal of Education and Pedagogy (IJEAP)*, vol. 4, no. 3, pp. 199-208, 2022.
- [10] Dowd, J. E., Connolly, M. P., Thompson Jr, R. J., & Reynolds, J. A. "Improved reasoning in undergraduate writing through structured workshops," *The Journal of Economic Education*, vol. 46, no.1, pp. 14-27, 2015.
- [11] Arcos-Alonso, A., Garcia-Alvarez, M., & Azpuru, A. G., "Macroeconomics and active methodologies in higher education: A possible pairing and a possible binomial," *Cypriot Journal of Educational Sciences*, vo. 17, no. 1, pp. 193-204, 2022.
- [12] Jain, A, "Students 'Perceptions of Workshop Based Introductory Macroeconomics Tutorials: A Survey," *Economic Papers: A journal of applied economics and policy*, vol. 25,no.3, pp.235-251, 2006.
- [13] Izci, K., "Internal and External Factors Affecting Teachers' Adoption of Formative Assessment to Support Learning," *Online Submission*, vol. 10, no.8, pp. 2774-2781, 2016.
- [14] Abdullah, S. A. S., & Abd Razak, N. A., "Pola Kesilapan Matematik Dalam Kalangan Pelajar Tahun Satu Kejuruteraan. In Seminar Matematik 2005," *UiTM Shah Alam*, 2005.
- [15] Tun'isah, I. F., "Analisis Kesalahan Dalam Menyelesaikan Soal Matematika Pokok Nahasan Lingkaran Pada Siswa Kelas VIII SMP Negeri 14 Malang," (*Doctoral dissertation, Universitas Negeri Malang*), 2011.
- [16] Ismail, A. F., Ali, M., "Analisis Kesilapan Dalam Tajuk Ungkapan Algebra Di Kalangan Pelajar Tingkatan Empat," *Buletin Persatuan Pendidikan Sains dan Matematik Johor*, Jilid 17 Bil. 1 Tahun 2007.
- [17] Mohd Yusak, N., & Bakar, M. N., "Mengenalpasti Kesalahan Pelajar Dalam Pembelajaran Topik Ungkapan Algebra dan Aplikasinya Dikalangan Pelajar Tingkatan 4," *Doctoral dissertation, Universiti Teknologi Malaysia* , 2007.
- [18] Tun'isah, I. F., "Analisis Kesalahan Dalam Menyelesaikan Soal Matematika Pokok Nahasan Lingkaran Pada Siswa Kelas VIII SMP Negeri 14 Malang," *Doctoral dissertation, Universitas Negeri Malang*, 2011.
- [19] Krejcie, R. V., & Morgan, D. W., "Determining Sample Size for Research Activities". *Educational and Psychological Measurement*, vol. 30, no. 3, pp. 607-610,1970.

- [20] Chua Yan Piaw, "*Buku 1 Kaedah Penyelidikan*," *Mc Graw Hill, Malaysia*, 2006
- [21] Dicky, W., Salmy, E., & Hairunnizam, W., "Self-Esteem Levels of the Indebted Lower Income Group and the Role of Organizations in the Plantation Sector Melayu," *Jurnal Antarabangsa Dunia Melayu*, 2019.
- [22] Safari, A., "The Effect of Workshop Training Method and Electronic Teaching Method on Mathematics Learning," *European Journal of Multidisciplinary Studies*, vol. 1, no.6, pp.166-171, 2016.

AUTHOR'S INFORMATION

<p>First Author: Zainab Binti Ali Taha</p> 	<p>Mathematics, Science and Computer Department, Politeknik Ibrahim Sultan, KM 10, Jalan Kong Kong, , 81700, Pasir Gudang ,Johor, Malaysia</p> <p>E-mail: zainab@pis.edu.my</p>
<p>Second Author: Wan Hamiza Binti Wan Hasan</p> 	<p>Mathematics, Science and Computer Department, Politeknik Ibrahim Sultan, KM 10, Jalan Kong Kong, , 81700, Pasir Gudang ,Johor, Malaysia</p> <p>E-mail: wanhamiza@pis.edu.my</p>
<p>Third Author: Suhana Binti Abdul Aziz</p> 	<p>Mathematics, Science and Computer Department, Politeknik Ibrahim Sultan, KM 10, Jalan Kong Kong, , 81700, Pasir Gudang ,Johor, Malaysia</p> <p>E-mail: suhana@pis.edu.my</p>