

BOOST UP YOUR MATHEMATICAL SKILLS WORKSHOP: AN INTERVENTION PROGRAMME FOR ENGINEERING STUDENTS

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ABSTRACT

Further Differential Equations (MAT480) is one of the mathematics courses that needs to be taken by undergraduate students of the College of Civil Engineering, UiTM Cawangan Pulau Pinang. In the October 2022 - February 2023 semester, 30% of students failed this course. To ensure that students in the March 2023 - August 2023 semester achieve good results, an intervention programme called Boost Up Your Mathematical Skills Workshop was conducted for the first three weeks of the semester. The programme involved seven lecturers from the Department of Computer Science and Mathematics and 132 students. In the first week, students were given a pre-test to assess their skills on topics they had previously learned. The selection of topics took into account their relevance to the subject. In the second week, students were asked to watch videos related to the subject as part of the intervention programme to improve their skills. They were also given questions to discuss in small groups. At the end of the second week, students presented their solutions to the problems to their peers and the facilitators, consisting of mathematics lecturers. In the third week, students took a post-test to measure their progress throughout the intervention programme. The Boost Up Your Mathematical Skills Workshop is expected to strengthen the mathematical foundation of students and increase their confidence while studying MAT480.

Keywords: *intervention; further calculus; peer; self-monitoring studies; facilitator.*

Introduction

Further Differential Equations (MAT480) is a critical mathematics course that needs to be taken by undergraduate students of the College of Civil Engineering, UiTM Cawangan Pulau Pinang. The course is a prerequisite for graduation, and it is essential that students perform well in it. However, in the October 2022 - February 2023 semester, 30% of students failed this course. In response to this, an intervention programme called Boost Up Your Mathematical Skills Workshop was developed to improve student outcomes. This workshop used a combination of open and distance learning (ODL) and traditional or face-to-face teaching and learning. The workshop involved seven lecturers from the Department of Computer Science and Mathematics, UiTM Cawangan Pulau Pinang and 132 undergraduate students of the College of Civil Engineering, UiTM Cawangan Pulau Pinang of semester six, seven and eight.

Literature Review

In their study, Arif and Mirza (2017) examined the effectiveness of an intervention programme in fostering the academic resilience of non-resilient at-risk students at the secondary school level. The intervention program had a positive impact on students' academic achievement, including their grades, and significantly improved their motivation (Jie et al., 2022). The most effective interventions involved one-on-one or small-group instruction (Ross & Begeny, 2011). Furthermore, intervention programme has been found to significantly improve students' confidence in learning mathematics (Dennis, 2016). Research has shown that students who work who in cooperative groups have higher academic achievement and better peer relationships than those work in competitive or individualistic structures (Qureshi et al., 2021). In addition, the report by Magruder and Kumar (2018) emphasized the critical role of facilitators in e-learning environments by providing support, guidance, and feedback to learners, ultimately leading to better learning outcomes.

According to a recent study published in the Journal of Educational Psychology, self-monitoring studies are an important factor for academic success in college students (Ghanizadeh, 2017). The study found that self-monitoring study, along with reflective thinking and critical thinking, significantly predicted academic achievement in college students.

Meanwhile, Nadeak and Naibaho (2020), found that video-based learning had a positive impact on students' learning outcomes. Specifically, students who used video-based learning had higher academic achievement and better learning performance than those who did not use this method. The authors concluded that video-based instruction can be an effective instructional method for promoting student learning in higher education settings. This study can be useful for educators and instructional designers who are interested in incorporating video-based instruction into their teaching practises.

Methodology

The programme was designed to help engineering students improve their mathematical skills and excel in MAT480. The workshop was held during the first three weeks of the March-August 2023 semester. The programme was divided into three parts.

During the first week, the students were given an online pre-test via uFuture. uFuture is the portal used by Universiti Teknologi MARA (UiTM) students, faculty and staff to access various services and resources related to their academic and administrative needs. This pre-test was given to evaluate students' understanding of the topics they had learned in previous semesters. The topics were carefully selected based on their relevance to MAT480. The pre-test results served as a baseline measurement for the students' mathematical proficiency. The topics that are covered in this program include differentiation using product rule and quotient rule, techniques of integration using by parts and

algebraic integration, nonpolynomial versus polynomial, Taylor and Maclaurin series and sketching a basic graph.

During the second week, the students were asked to watch videos related to differentiation using product rule and quotient rule, techniques of integration using by parts and algebraic integration, nonpolynomial versus polynomial, Taylor and Maclaurin series and sketching a basic graph to enhance their skills. These videos were given to assist students doing self-monitoring studies and to support e-learning. They were also given questions to discuss in small groups, which helped facilitate self-monitoring studies. The lecturers encouraged active participation by monitoring students' participation and providing guidance to help the students improve their mathematical abilities.

At the end of the second week, students were asked to present their solutions to problems to their peers and the facilitators, who were mathematics lecturers. This interactive session provided an opportunity for the students to learn from each other's mistakes and clarify any doubts they had with the facilitators. This two-way learning approach allowed for the correction of errors and misunderstandings in real-time.

Finally, in the third week, students were asked to answer an online post-test via the uFuture portal to measure their progress throughout the programme. This post-test provided an opportunity for the facilitators to gauge the success of the intervention programme and identify areas that need improvement.

Discussion

The development of the intervention programme shown in Figure 1 incorporates three main elements: self-monitoring studies, peers and facilitators. The integration of these elements is crucial for success in any field and is particularly important in mathematics education.

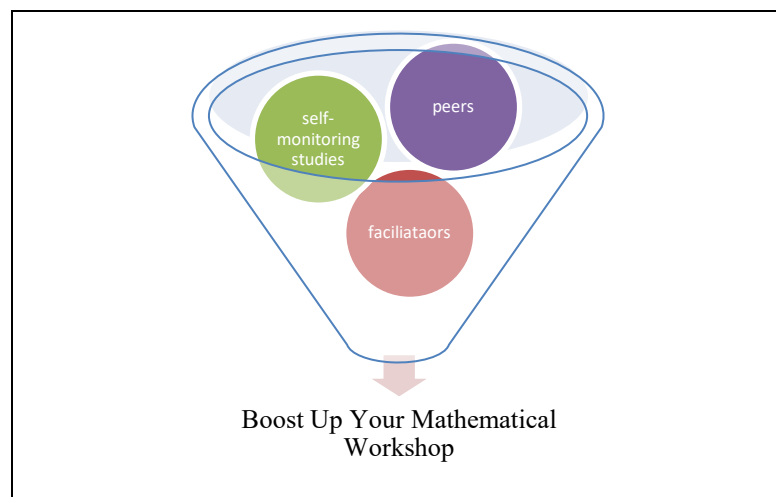


Figure 1: Three main elements in development of intervention program
“Boost Up Your Mathematical Workshop”

Self-monitoring studies allow students to take ownership of their learning and develop self-directed learning skills. Self-monitoring studies can help students develop self-directed learning skills, such as setting their own goals, planning and monitoring their own learning, and taking responsibility for their learning outcomes (Zhu, Bonk & Doo, 2020). Through self-monitoring studies, students can deepen their understanding of course material and explore topics of personal interest. Peers also play a vital role in the learning process, as they can provide support, encouragement, and feedback to one another. Peer learning has been shown to improve student engagement and academic performance in a variety of settings. Peer-assisted learning can be an effective approach to promote active learning and enhance students' learning experiences (Makala, 2017). Facilitators, such as instructors and tutors, serve as guides and mentors for students. They provide expertise, guidance, and feedback on student progress, as well as creating a supportive and inclusive learning environment. By integrating these three elements into the intervention programme, students can develop a strong foundation in calculus and gain the confidence and skills needed to succeed in their academic and professional pursuits.

Result

From Figure 2, we can see that the scores for all the participants have increased from the pre-test to the post-test. The average score for the pre-test is 5.13, while the average score for the post-test is 7.16. The difference between the two scores shows an improvement in the students' performance. The post-test scores are higher than the pre-test scores, indicating that the students have gained knowledge and skills during the period between the pre-test and post-test. The average difference between the pre-test and post-test scores is 2.03, which suggests that the students have made significant progress. This improvement could be due to the students' learning from the intervention programme that was implemented during the period between the two tests. It is also possible that the students were more familiar with the testing process during the post-test, which could have contributed to the increase in their scores.

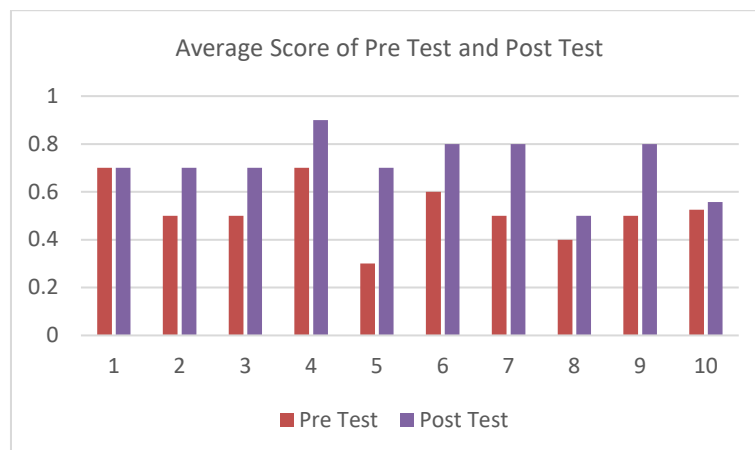


Figure 2: Average score of pre-test and post-test

Conclusion

In conclusion, the Boost Up Your Mathematical Skills Workshop provided a unique and interactive approach to learning. The programme use of peer learning and small-group instruction allowed students to learn from their peers and facilitators, providing them with a more personalized learning experience. Through this approach, the programme has successfully helped students overcome their fear of mathematics and instilled confidence in them. The Boost Up Your Mathematical Skills Workshop can be a model for other programme aimed at helping students overcome their difficulties in mathematics. The programme effectiveness in improving students' mathematics skills and confidence in learning can serve as a model for other similar programmes aimed at helping students overcome their difficulties in mathematics. Overall, the Boost Up Your Mathematical Skills Workshop has demonstrated that a supportive and personalized learning environment can have a positive impact on students' confidence in learning. As such, it is essential for educational institutions to prioritize the development of such programme that provide students with the necessary support to succeed academically and beyond.

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