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# INVESTIGATING THE CORRELATION BETWEEN MOOC PARTICIPATION IN FURTHER DIFFERENTIAL EQUATIONS AND STUDENTS' FINAL GRADES

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**ABSTRACT**

*The increasing prevalence of Massive Open Online Courses (MOOCs) in higher education makes it crucial to understand their impact on students' academic performance. This study examines the relationship between participation in MOOCs on Further Differential Equations and students' final grades across several semesters. Focusing on undergraduate engineering students enrolled in the Further Differential Equations (MAT480) course as part of the Civil Engineering degree program at UiTM Cawangan Pulau Pinang, data were collected from the academic years 2023 and 2024. The comparison was made between students who completed the MOOC and those who did not, as well as between students who passed or failed their final exams. The results show a Pearson's correlation coefficient of 0.998, indicating a very strong positive correlation between MOOC completion and higher passing rates. This suggests that students who complete more MOOCs tend to have higher passing rates in their final grades. However, more research is needed to understand other factors affecting student success.*

***Keywords: MOOCs, academic performance, Further Differential Equations, civil engineering education, undergraduate students.***

## Introduction

In recent years, MOOCs have gained significant traction in higher education as a flexible and accessible method for students to enhance their learning. MOOCs also have become more popular worldwide especially after the outbreak of COVID-19 (Liu et al., 2021; Alamri 2022). Many researchers believe that MOOCs are important in educating more people (Gallego-Romero et al, 2020). These courses provide valuable opportunities for students to gain knowledge beyond the traditional classroom setting, offering a range of subjects, including advanced topics like Further Differential Equations. This study focuses on understanding the impact of MOOC on academic performance, specifically examining its influence on students enrolled in the MAT480 course as part of the Civil Engineering degree program at UiTM Cawangan Pulau Pinang.

Differential equations are a critical component of engineering education, forming the foundation for various applications in civil engineering and related fields. Mastering these concepts are

essential for students to succeed in this course and future professional practice. Despite the potential benefits of MOOCs in supplementing traditional learning, the relationship between MOOC's participation and student outcomes remains underexplored. This study aims to fill this gap by investigating whether participation in Further Differential Equations MOOC positively correlates with students' final grades.

The increasing integration of online learning platforms in academia necessitates a thorough understanding of their effectiveness. Previous research has highlighted mixed outcomes regarding the impact of MOOCs on students' performances, with some studies indicated improvements in grades and others showed negligible effects. By analyzing data from semesters spanning from 2023 to 2024, this study seeks to provide empirical evidence on the relationship between MOOC's participation and academic success, thereby offering insights into how online education can be leveraged to enhance learning outcomes in engineering programs.

Understanding the effectiveness of MOOCs in this context is crucial for educators and institutions that aim to optimize educational strategies and support student success. This research will contribute to the broader discussion on online education's role in higher learning and provide actionable recommendations for integrating MOOCs into engineering curricula.

**Literature Review**

MOOCs have revolutionized higher education by providing accessible, flexible learning opportunities to students worldwide. Compared to traditional classroom teaching, MOOCs provide "any-time" learning and the potential to enrol diverse groups of international learners (Lazarus and Suryasen, 2022). Furthermore, MOOCs provide a diverse array of subjects and frequently serve as a supplement to traditional classroom instruction. MOOCs expand educational access, encourage lifelong learning, and equip learners to adapt to technological advancements (Rulinawaty, et al., 2023). It has been praised for their potential to democratize education and offer supplementary learning resources (Yuan & Powell, 2013). However, their effectiveness in improving academic performance remains a subject of ongoing research.

MOOCs have had varying effects on students' academic performance. Several studies suggest that MOOCs can positively influence learning outcomes by providing additional resources and practice opportunities. High-quality, well-structured online content is essential for student satisfaction. When students are satisfied with the content, they are more likely to engage deeply with the material, leading to better academic outcomes (Taip, et al., 2023). In addition, a study by Kizilcec et al. (2013) found that

students who engaged with supplementary online resources demonstrated improved performance in their traditional courses. Similarly, a study by Chen et al. (2018) reported that students who completed MOOCs scored higher grades in related subjects, indicating a positive correlation between MOOC participation and academic success. According to Pérez-Sanagustín et al. (2021), students who obtained moderate grade point averages (GPAs) demonstrated greater engagement with the course curriculum in comparison to those who had relatively high or low GPAs. Thai, et al. (2020) stated that there is a significantly positive impact on learning performance when studying in a flipped classroom (FC) and blended learning (BL) environment compared to face-to-face learning (F2F) or fully e-learning (EL). However, in a study conducted in a business school in northern India, there is a significant number of candidates dropped out of these MOOC courses due to various barriers, such as usage barriers, value barriers, tradition barriers, and image barriers (Dang, et al., 2022).

While there is substantial literature on MOOCs and their general impact on education, there is limited research specifically focus on the correlation between MOOC participation and final grades in specialized courses like Further Differential Equations. Existing studies often address MOOCs' broader impacts without delving into specific subject areas. This study aims to address this gap by investigating the relationship between MOOC participation and final grades in the MAT480 course, providing valuable insights for educators and institutions seeking to enhance educational outcomes through online learning resources.

**Methodology**

This study employs a quantitative research design to investigate the relationship between participation in the Further Differential Equations MOOC and students' final grades. This research focused on undergraduate students enrolled in the MAT480 course under the Civil Engineering degree program at UiTM Cawangan Pulau Pinang. Data from academic records for the years 2023 and 2024 were analyzed in this study.

This study included all students who were enrolled in the course and had the opportunity to participate in the associated MOOC. The samples consist of students who completed the MOOC and those who did not, providing a comprehensive view of the impact of MOOC participation on academic performance. Correlation analysis was conducted to assess the relationship between MOOC completion and final grades. This includes calculating Pearson's correlation coefficient to determine the strength and direction of the relationship.

Several limitations are acknowledged in this study, such as other external factors influencing academic performance, such as teaching quality and student engagement. These factors were not included in this study and the findings are specific to the MAT480 course and may not be generalizable to other courses or institutions.

**Results**

Data collected from undergraduate students enrolled in the MAT480 course during the academic years 2023 and 2024 were analysed. Table 1 shows the participation in the Further Differential Equations MOOC and students' final grades. Pearson's correlation coefficient was calculated to assess the relationship between MOOC completion and final grades. The Pearson's correlation coefficient value of 0.998 indicates a very strong positive correlation between the number of completed MOOC and the number of students who passed the MAT480 course. This suggests that students who completed more MOOCs tend to achieve higher passing rates in their final grades.

Table 1: Participation In MOOCs on Further Differential Equations and Students' Final Grades

| | MOOC | | | | Final Grade | | | |
|---|---|---|---|---|---|---|---|---|
| | Completed | | Uncompleted | | Passed | | Failed | |
| Semester | Number of students | % | Number of students | % | Number of students | % | Number of students | % |
| 20232 | 114 | 89 | 14 | 11 | 124 | 95 | 6 | 5 |
| 20234 | 17 | 89 | 2 | 11 | 18 | 86 | 3 | 14 |
| 20242 | 106 | 90 | 12 | 10 | 109 | 90 | 12 | 10 |

Figure 1 shows the scatter plot of the relationship between the percentage of students who completed the MOOC and the percentage of students who passed the final examinations. The completion rates for this MOOC are very high (around 89-90%) and the passing rates are also high (86-95%) throughout the three semesters. This suggests a strong commitment to completing MOOC and a high success rate in final grades. The percentages of students who completed the MOOC and passed students are quite consistent across the semesters, indicating a stable pattern in both MOOC completion and academic performance.

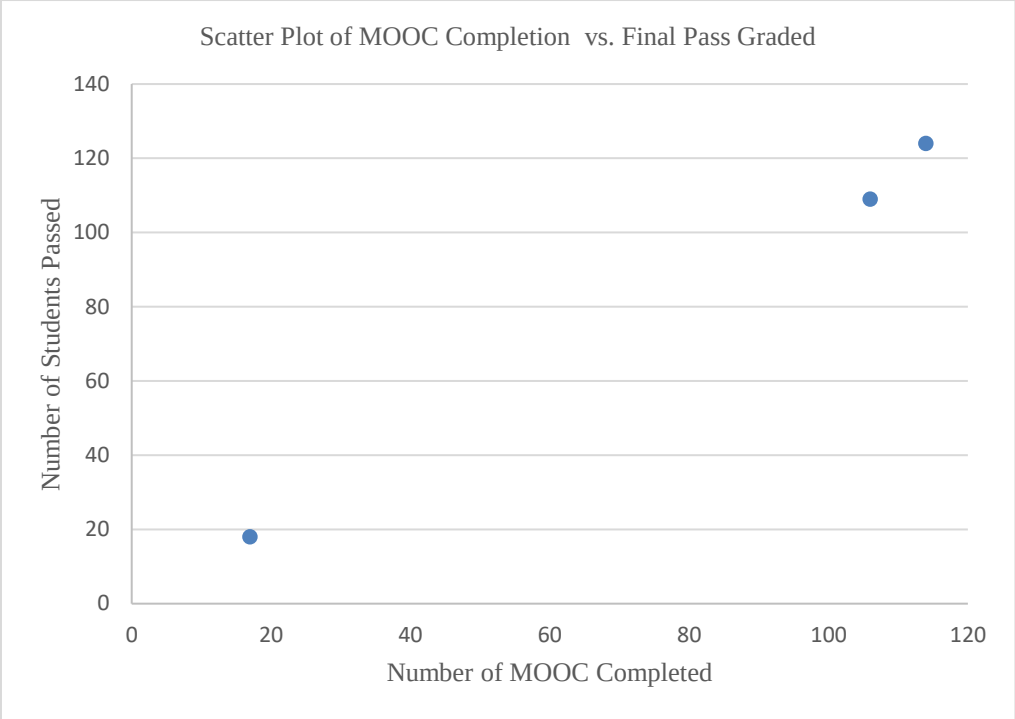


Figure 1: The relationship between the number of students who completed the MOOC and the number of students who passed the final examinations

**Discussion**

Across three semesters, both MOOC completion rates and passing rates were consistently high, with completion rates around 89-90% and passing rates between 86-95%. This consistency indicates a strong commitment to complete MOOCs and correspond to high success rate in final grades (Taip, et al., 2023). The strong positive correlation observed suggests that the Further Differential Equations MOOC can enhance students' understanding of the subject, potentially leading to improved academic outcomes. This finding aligns with previous research indicating that supplementary online resources can positively influence learning and performance (Chen et al., 2018).

Incorporating MOOCs into the curriculum can provide additional learning resources and support for students. Given the positive impact observed, integrating MOOCs as a supplementary tool for complex subjects like Further Differential Equations may help students better grasp challenging concepts and improve their performance. While MOOCs can enhance learning, they should be thoughtfully integrated with traditional teaching methods. The effectiveness of MOOCs in improving academic performance is maximized when used alongside conventional instruction, as suggested by studies highlighting the importance of a blended learning approach (Luo et al., 2014, Thai, et al., 2020).

Several limitations of this study should be considered. This study focuses on a specific course and institution, which may limit the generalizability of the findings. Results may differ in other subjects or educational settings. While prior academic performance and attendance are controlled in this study, other factors such as student motivation, study habits, and external support were not taken into consideration. These variables may also influence academic performance and should be explored in future research.

Further research is needed to build on these findings and address existing limitations. Expanding the study to include multiple courses, institutions, and disciplines could provide a more comprehensive understanding of MOOCs' impact on academic performance. Incorporating qualitative methods such as surveys or interviews with students could offer insights into their experiences with MOOCs and identify factors influencing their effectiveness. Longitudinal studies could examine the long-term effects of MOOC participation on students' academic and professional outcomes, providing a deeper understanding of their overall impact.

## Conclusion

The results indicate a strong positive correlation between MOOC participation and improved final grades, suggesting that MOOCs can be an effective supplementary tool for enhancing students' understanding and performance in complex subjects. In conclusion, MOOCs hold considerable potential to improve academic outcomes in higher education, particularly when used as part of a blended learning approach. By leveraging MOOCs effectively and addressing challenges related to student engagement and completion, educators can enhance the learning experience and support students in achieving their academic goals. Continuous exploration and refinement of online learning resources will contribute to optimizing educational practices and fostering student success.

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