Impact of Post-Movement Control Order on Mathematics Performance among Non-Science Stream Diploma Students in University Teknologi MARA, Campus Segamat

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Abstract
The implementation of the Movement Control Order (MCO) during the COVID-19 pandemic resulted in prolonged school closures and a rapid transition to online learning, raising concerns regarding its lasting effects on students' mathematical achievement. This study examines the relationship between mathematics performance and students' perceptions of online learning during secondary school, as well as their learning experiences in Business Mathematics at the tertiary level, among non-science stream students. A cross-sectional survey design was employed involving 168 Diploma students from Business-related programmes at Universiti Teknologi MARA (UiTM), Johor Branch, Campus Segamat. Data were collected using an adapted structured questionnaire and analysed using descriptive statistics, Pearson correlation, and multiple regression techniques. The findings indicate weak and statistically non-significant relationships between mathematics performance and students' perceptions of online learning at both secondary and tertiary levels. Regression results further reveal that these perceptions account for only a minimal proportion of the variance in mathematics performance. The results suggest that post-MCO mathematics achievement among non-science stream students is influenced more substantially by factors beyond perceived online learning experiences, such as foundational knowledge gaps and cumulative learning disruptions. The study highlights the need for targeted instructional and remedial strategies at the tertiary level to mitigate the long-term educational consequences of pandemic-induced learning disruptions.
Keywords: Education Challenges, Online Learning, Mathematics Education, Covid-19 Education Impact, Non-Science Stream

Introduction

Numerous studies have shown that the COVID-19 pandemic has led to declines in education performance from primary to tertiary level, as well as changes in the educational environment. Within the social sciences, these declines are widely discussed in terms of learning loss, educational inequality, and the long-term consequences of emergency remote instruction. Due to the Movement Control Order (MCO) that has been implemented from 2020 to 2021, the traditional physical classroom has been shifted to an online virtual classroom. This transformation has been identified as key factors contributing to this learning deficiency (Jalani et al., 2022).

The impact of pandemic on mathematical achievement was different across nations and regions due to the robustness of each country's education system (Qiu et al., 2024). This variation has fuelled ongoing debates on whether pandemic-related learning losses are temporary setbacks or structural disruptions that may persist across educational stages. For example, a study from Spain has shown that students in the ninth grade had 22.17% lower post-pandemic math scores if compared to their pre-pandemic counterparts (Spain and Jaume, 2022). Similarly, in Indonesia, 91.17% of pupils were struggling with math after the pandemic and caused them to have an extremely low math achievement (Gunawan et al., 2024). These empirical findings collectively suggest that mathematics is among the subjects most vulnerable to large-scale educational disruptions.

Due to the MCO, Malaysia's educational framework has been significantly transformed, the issue of learning deficiencies also arising, particularly for the subject of mathematics (Asadullah, 2022). This issue is especially concerning as mathematics plays a critical role in developing logical reasoning and problem-solving skills, which are essential for socioeconomic mobility. Based on the findings of the Trends in Mathematics and Science study, Malaysian students' performance in mathematics, especially in foundational areas such as algebra, exhibited an apparent decrease when compared to their peers in other countries (Mohammadpour et al., 2024).

According to Barba et al. (2024), mathematics proficiency among the incoming tertiary students has been affected by the emergency remote instruction that has been implemented during MCO. The contributing factors to this decline was due to our education had shifted from fostering conceptual understanding to teaching techniques that were less cognitive engaging, and Malaysia was not the only country with this troubling trend (Gasteiger et al., 2023). This shift reflects a broader concern in education research regarding the reduced emphasis on higher-order thinking skills during online instruction.

Mathematics is a subject that requires cumulative and progressive knowledge, therefore a strong foundation in math is very important when solving higher-level mathematics problems (Zin et al., 2025). Disruptions at early stages may therefore have compounding effects that extend well beyond the pandemic period. The research has shown secondary school students' performance was declining during the COVID-19 pandemic period (Kim et al., 2022).

In fact, non-science stream students faced more challenges compared to science stream students during the MCO (Romli, 2023). This is because non-science stream students had less exposure to mathematics, especially those who were weak in performing mathematical skills.

From an educational equity perspective, this uneven exposure raises concerns about widening achievement gaps between student streams. The shift to remote learning has drastically reduced opportunities for interactive instruction, real-time feedback, and structured practice, all of which are essential elements for efficiently studying mathematics (Kim, 2022).

Without doubt, students faced challenges when having online learning, primarily due to a lack of motivation, unstable internet connections, or inappropriate learning environments (Almarashdi, 2024). Besides that, poor internet connectivity, ineffective teaching methods, and reduced student engagement are also challenges faced by students that affect the development of their math skills (Pecjo, 2022). These challenges highlight structural constraints that disproportionately affect students from less academically supportive environments.

Research has shown a substantial decrease in secondary school students' math performance during the MCO period, with lower-ranking students experiencing a particularly sharp decline (Kim et al., 2022). This suggests that MCO-induced online classes had a significant impact on students with a weak math foundation, especially non-science stream student who have limited engagement with mathematics (Shearman et al., 2012). As a result, the learning gap between science and non-science stream students is likely to have widened post-MCO, posing long-term implications for access to quantitative fields of study.

Mathematics' Performance Post-MCO
International assessments, including the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA), indicate that Malaysian students consistently perform below the global average in mathematics (Musa & Maat, 2021). This might be due to Malaysian educational systems failed to develop critical thinking abilities in mathematics which is necessary for effective problem-solving and synthesis (Singh et al., 2018). These findings position Malaysia within broader international discussions on curriculum effectiveness and post-pandemic educational recovery.

During the MCO, all institution shifted the learning process to online platforms. This action had ensured students get the continuity of education, but at the same time, it also increased the learning challenges, especially for the subject of Mathematics (Tsui and Mok, 2024). According to the PISA 2018 result that was conducted before MCO, half of Malaysia's students have showed did not have a solid understanding of mathematical skills (Ling & Mahmud, 2023). While the performance in PISA 2022 degrades, which dropped from 440 in 2018 to 409 in 2022 (Wei et al., 2025). This decline provides empirical evidence that existing weaknesses in mathematics performance were further exacerbated after the MCO.

This decline in math performance was contributed by several challenges that faced by students during the MCO-induced online classes that conducted since 2020, such as mathematics anxiety, dyscalculia, and a low intelligence quotient (Nomsa et al. 2021). In addition, alterations in classroom environments and shifts in teaching delivery methods have influenced students' cognitive development, thereby affecting their mathematics performance (Makofane & Maile, 2019). The availability of learning resources during the

online lesson also influences their success in mathematics (Agathi et al., 2024). These factors collectively indicate that learning loss is multifaceted rather than solely content-based.

The transition to online learning during the MCO were limited all essential components of mastering mathematical concepts, such as interactive teaching, immediate feedback, and structured practice (Joshi et al., 2024). Compared to science stream students, non-science stream students are more vulnerable to this effect because they have less frequent exposure to mathematics (Shvets et al., 2022). This vulnerability underscores the need to examine stream-specific post-pandemic learning outcomes.

Moreover, the early secondary years are critical for building foundational mathematics skills (Wriston, 2015). Consequently, students who experienced online learning during the COVID-19 MCO at the junior secondary level will likely continue to be affected by these disruptions when they pursue studies at the tertiary level. This is because mathematics is a cumulative subject, and gaps in foundational knowledge can compound over time, making it difficult for students to grasp more advanced concepts in later grades (Fathi et al., 2025). This also implies, these students may face continued challenges in quantitative subjects at the tertiary level, such as statistic, accounting and business mathematics. Despite growing international evidence on pandemic-related learning loss, studies focusing on the long-term effects of MCO on Malaysian non-science stream students at the tertiary level remain limited.

To determine whether post-MCO disruptions continue to affect students' mathematics performance, this study was conducted. The respondents are Diploma in Business Management students at Universiti Teknologi MARA, Cawangan Johor, Kampus Segamat, who experienced online classes during the MCO while they were in Form 1 or Form 2 and some of them were also part of the batch that participated in PISA 2022. This study therefore aims to provide empirical evidence on the persistence of MCO-related learning deficiencies and contribute to ongoing debates on post-pandemic educational recovery and inequality within the Malaysian context.

Research Objectives and Scope
In response to these gaps, this study aims to examine whether the disruptions caused by MCO-induced online learning continue to affect students' mathematics performance at the tertiary level. Specifically, the study focuses on Diploma in Business Management students at Universiti Teknologi MARA (UiTM), Cawangan Johor, Kampus Segamat, who experienced online mathematics instruction during Form 1 or Form 2, with some respondents belonging to the cohort assessed in PISA 2022.

The objectives of this study are to assess the current level of mathematics performance among post-MCO non-science stream tertiary students, examine the extent to which MCO-induced online learning may have contributed to persistent learning deficiencies in mathematics, and contribute empirical evidence to ongoing debates on post-pandemic learning recovery and educational inequality, particularly within the Malaysian context.

By addressing these objectives, this study seeks to complement existing international findings and provide context-specific insights that may inform curriculum design, instructional

strategies, and targeted interventions to support students with weak mathematical foundations in the post-pandemic era.

Methodology
Sampling Design
This study is a cross-sectional study in which data were collected over a period of four weeks. The population consists of students from the Diploma in Business Studies (BA111), Diploma in Investment Analysis (BA114), and Diploma in Banking Studies (BA119), comprising students from Part 1 to Part 5 at Universiti Teknologi MARA (UiTM), Segamat Campus. A total of 168 respondents were selected as the sample for this study. Convenience sampling was used to select respondents who met the criteria, namely students who experienced online classes during the post-MCO period. This sampling technique was chosen because it is cost-effective and easy to implement.

Data Collection Method
Online questionnaires were used to collect data from the respondents. A Google Form was created, and the link was distributed to respondents via WhatsApp and Telegram platforms. This method was chosen because of its cost-effectiveness and convenience, as respondents could complete the questionnaire at their own pace, at a time of their choosing, and using their preferred device.

Research Instrument
The questionnaire was adopted from a previous study by Zin et al. (2025). This study focuses on social science students. The questionnaire comprised four sections. Section A captured socio-demographic information, including gender, semester, programme, current Cumulative Grade Point Average (CGPA), and SPM Mathematics results. Section B addressed general questions related to online learning during the Movement Control Order (MCO). Section C focused on students' perceptions of their experience learning mathematics through online learning in secondary schools. Finally, Section D comprised questions on perceptions of the experience of learning Business Mathematics at UiTM Segamat. Responses for Sections C and D were measured using a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Method of Analysis
In this study, the data was analyzed using IBM SPSS version 26. Several statistical methods had been used to analyze the data such as descriptive statistics (frequency table), Pearson correlation analysis and multiple regression analysis.

Descriptive statistics were used to summarize participants' characteristics, with categorical variables presented as frequencies (n) and percentages (%). Pearson correlation analysis was then used to examine the relationship between the two variables. The formula for Pearson's correlation coefficient, r, is written as:

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]\left[\sum y^2 - \frac{(\sum y)^2}{n}\right]}}$$

Where y is dependent variable, x is independent variables and n is 168 students. Kya et al. (2022) explain that a correlation coefficient close to −1.0 indicates a strong negative relationship between two variables, while a value nearing +1.0 reflects a strong positive relationship. In contrast, a correlation coefficient around or equal to zero suggests that there is no linear relationship between the variables

Furthermore, the multiple regression analysis is used to determine the factors that the impact of Mathematics performance based on students' perceptions of their experience learning mathematics through online learning in secondary schools and learning Business Mathematics at UiTM Segamat. The multiple linear regression is given by:

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon_i$$

where y_i is the mathematics performance, x_1 is students' perceptions of their experience learning mathematics through online learning in secondary schools, x_2 is perceptions of the experience of learning Business Mathematics at UiTM Segamat and ε_i is error term.

Results and Discussion
Results
Demographic Profile
Based on Table 4.1, 58.9% of the respondents are female, while the remaining 41.1% are male. In terms of academic programme, students enrolled in BA111 represent the highest proportion at 39.3%, followed by BA119 at 35.1%, and BA118 at 25.6%. Meanwhile, majority of respondents are Part 1 students, accounting for 70.8% of the sample. This is followed by Part 2 students at 22.6%, while Part 4 students make up the smallest group at 0.6%.

Table 4.1
Demographic Profile (n = 168)

Category	n	%
Gender		
Male	69	41.1
Female	99	58.9
Program		
BA111	43	35.1
BA119	66	25.6
BA114	59	39.3
Semester		
Part 1	119	70.8
Part 2	38	22.6
Part 3	8	4.8
Part 4	1	0.6
Part 5	2	1.2
SPM Grade for Mathematics		
A+/A	62	36.9
A-	11	6.5
B+	24	14.3
B	10	6.0
C+	25	14.9
C	20	11.9
D	8	4.8
E	8	4.8

General Questions Related to MCO
Based on Table 4.2, approximately 48.2% of the respondents attended online classes during secondary school at Form 1, followed by Form 2 (35.7%). The lowest proportion of respondents attended online classes at Form 4, accounting for only 1.8%. In addition, Google Meet was the most commonly used e-learning platform for online classes during secondary school, with 96.4% of respondents reporting its use. This was followed by Google Classroom (72%), Telegram (62.5%), and Quizizz (56%). The least used platforms were Spectrum and WhatsApp.

Table 4.2
General Questions

Category	n	%
Grade level when online classes were taken during secondary school.		
Form 1	81	48.2
Form 2	60	35.7
Form 3	19	11.3
Form 4	3	1.8
Form 5	5	3.0
E-learning platforms used by secondary schools for online learning.		
Microsoft Team	18	10.7
Telegram	105	62.5
Zoom	74	44.0
Google meet	162	96.4
Google Classroom	121	72.0
Webex	4	2.4
Kahoot	60	35.7
Quizziz	94	56.0
Padlet	6	3.6
Spectrum	1	0.6
Whatsapp	1	0.6

The Relationship Between Mathematics Performance and Students' Perceptions of Online Learning in Mathematics Subjects at Secondary School
From table 4.3, the finding shows that the value of r is equal to 0.127 (p-value = 0.100). It indicates that there is a weak positive correlation between mathematics performance and students' perceptions of online learning in Mathematics at secondary school. This shows that students' perceptions of online mathematics learning in secondary school only slightly affect their Mathematics academic results.

Table 4.3
Correlation Table

	Mathematics Performance	Students' Perceptions of Online Learning in Mathematics at Secondary School
Mathematics Performance	1	0.127
Students' Perceptions of Online Learning in Mathematics at Secondary School		1

*** Correlation is significant at the 0.01 level*

The Relationship between Mathematics Performance and Students' Perceptions of Online Learning in Business Mathematics at UiTM
Table 4.4 presents the value of r, which is 0.066 (p-value = 0.100). The findings show that there is no significant correlation between mathematics performance and students' perceptions of online learning in Business Mathematics at UiTM. This indicates that students' perceptions of online learning in Business Mathematics have no influence on their academic achievement in mathematics subject.

Table 4.4
Correlation Table

	Mathematics Performance	**Students' Perceptions of Online Learning in Business Mathematics at UiTM**
Mathematics Performance	1	0.396
Students' Perceptions of Online Learning in Business Mathematics at UiTM		1

*** Correlation is significant at the 0.01 level*

The Influence of Students' Perceptions of Online Learning in Mathematics at Secondary School and Business Mathematics at UiTM on Mathematics Performance
Table 4.5 presents the regression coefficients for the relationship between the dependent and independent variables. The value of R is 0.127, indicating a weak positive relationship between students' perceptions of online learning in Mathematics at secondary school and Business Mathematics at UiTM and mathematics performance. This suggests that students' perceptions of online learning in Mathematics at secondary school and Business Mathematics at UiTM have little predictive power in explaining mathematics performance. The R square value of 0.016 indicates that only 1.6% of the total variation in mathematics performance can be explained by students' perceptions of online learning in Mathematics at secondary school and Business Mathematics at UiTM. The remaining 98.4% of the variation may be attributed to factors not examined in this study. Furthermore, the results show that the p-values for both independent variables are greater than 0.05, therefore, the null hypotheses for each variable are not rejected. Hence, it can be concluded that students' perceptions of online learning in Mathematics at secondary school and Business Mathematics at UiTM do not significantly predict mathematics performance.

Table 4.5
Coefficients Table

	B	t	Sig (p-value)
Constant	2.385	4.670	0.000
Students' Perceptions of Online Learning in Mathematics at Secondary School	0.202	1.411	0.160
Students' Perceptions of Online Learning in Business Mathematics at UiTM	0.004	0.027	0.979
R	0.127		
R²	0.016		

Dependent variable: Mathematics Performance

Discussion

This study found that students' perceptions of online learning in Mathematics at secondary school and Business Mathematics at UiTM are not significant predictors of mathematics performance among social sciences students. This result is consistent with Aksan et al. (2021), who reported that students' perceptions of the modular distance learning approach did not affect academic performance in Mathematics. This indicates that mathematics performance, whether high, moderate, or low, does not depend on students' perceptions. Another study by Solidum et al. (2022) also found no relationship between learning styles in online distance learning and students' academic performance. This may be attributed to differences in students' experiences with online learning, levels of intelligence, and learning styles during virtual classrooms. Similarly, Madrilejos (2024) reported that mathematics performance was not significantly predicted by students' perceptions of online learning. Thus, in this study, although students' perceptions of online learning in Mathematics at secondary school show a significant correlation with mathematics academic performance, the weak correlation coefficients indicate a limited capacity to predict respondents' performance in the subject. This suggests that these factors may not have a significant impact on students' mathematics achievement during their university studies.

Conclusion

This study examined the extent to which students' perceptions of online learning during the Movement Control Order (MCO) at secondary school and their experiences learning Business Mathematics at the tertiary level influence mathematics performance among non-science stream Diploma students at UiTM Segamat. The findings demonstrate that students' perceptions of online learning, whether formed during secondary school or university studies, do not significantly predict their mathematics performance. Although weak positive associations were observed, the low correlation coefficients and insignificant regression results indicate that these perceptions possess limited explanatory and predictive capacity.

These findings suggest that the decline in mathematics performance observed in the post-MCO context cannot be adequately explained by students' subjective perceptions of online learning alone. Instead, more fundamental and structural factors such as disruptions to cumulative learning processes, weakened mathematical foundations during critical formative years, and individual differences in learning readiness are likely to exert a stronger influence on academic outcomes. This issue is particularly pronounced among non-science stream

students, who generally receive less intensive exposure to mathematics and are therefore more susceptible to learning loss during prolonged instructional interruptions.

From an educational perspective, the results underscore the importance of proactive academic interventions at the tertiary level. Institutions of higher learning should prioritise diagnostic assessments, targeted remedial programmes, and adaptive instructional approaches to address persistent mathematics learning gaps among post-pandemic cohorts. Future research is recommended to incorporate additional explanatory variables, such as mathematics anxiety, prior academic achievement, instructional quality, and learning strategies, as well as to employ longitudinal or mixed-method designs to gain deeper insight into the long-term effects of pandemic-related educational disruptions.

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