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Flexible Class Dismissal as a Pedagogical Strategy to Enhance Motivation in Mathematics Video Lessons

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Abstract

Flexibility in the learning environment enhances learner motivation. In this study, flexible class dismissal was implemented as a motivational strategy to enhance student engagement in mathematics video learning. The study involved 25 A-Level student participants who learned to solve equations and inequalities involving absolute value functions. Their independent learning followed a cycle comprising a pretest, engagement with self-directed instructional videos, and a posttest for each of the two domains. They were given autonomy to flexibly self-pace their learning and leave class on completing the learning cycles. Their scores on the pretests and posttests were compared with a paired-sample *t*-test, while their solution strategies were qualitatively analyzed. The findings revealed not only statistically significant improvement but also shifts in strategy toward more conceptual and efficient solutions. Such approach empowers students with autonomy as a source of motivation, enhances learning, and frees the instructor to support individual learners during class time.

Keywords: Autonomous Learning, Instructional Videos, Mathematics Learning, Motivation

Introduction

Mathematics is a crucial subject that receives focused attention in the education systems worldwide. Mathematics learning enables students to think logically and solve problems effectively. However, Waswa and Al-kassab (2022) found that mathematics is often viewed as a 'difficult' subject, which leads to the development of mathematics phobia among students, resulting in unsatisfactory performance in the subject. The challenges in learning mathematics, among others, include the difficulty in cultivating conceptual understanding, cognitive barriers, mathematics anxiety, ineffective teaching methods, socio-cultural factors, and resource accessibility issues (Mangarin & Caballes, 2024). Many students struggle to learn mathematics with low motivation, disinterest, and minimal engagement. Educational studies were undertaken to enhance understanding of the underlying issues (e.g., Bacong et al., 2023).

Motivation hence plays an important role to drive progress by helping students develop the will to overcome challenges, nurture a positive attitude toward learning, and build confidence in their abilities. Without motivation, students would hardly reach their full potential. This study therefore examined whether an intervention, combined with a motivational strategy, could enhance students' performance in mathematics learning.

Mathematical Performance

The mathematical performance of secondary-school students, particularly in the Sijil Pelajaran Malaysia (SPM) achievements, has been a key national concern due to observed fluctuations and declines over the years (Fuzi, et al., 2020; Kenyang & Wong, 2019; Zulkifli et al., 2024). Zulkifli et al. (2024) recently revealed increasing rates of failures in mathematical performance among diploma students. The researchers found a significant association between students' mathematics grades and their overall SPM performance. Kenyang and Wong (2019) revealed that 61% of the 62 students enrolled in a Foundation in Science program failed a mathematics pretest despite 24% of them having attained an A in their SPM mathematics results. Moreover, Fuzi et al. (2020) highlighted that tertiary students who did not learn Additional Mathematics at secondary level committed significantly more errors (e.g., concept, comprehension, expansion, and transformation errors) compared with those who ever took Additional Mathematics. In fact, many studies have concurred that SPM students entering Foundation programs commonly lack foundational mathematics skills. Yusof et al. (2023) found that over 60% of the newly enrolled Foundation students at a Malaysian university failed their initial mathematics diagnostic test. In addition, weak foundational learning in early mathematics education has contributed to learners' difficulties in solving mathematical tasks logically. High achievement in the SPM examination does not necessarily reflect strong mathematical foundation. Their high grades were largely attributable to their familiarity with exam question formats and their strategic memorization of past solutions, rather than a deep understanding of the underlying mathematical concepts (Gholami, 2023).

In the international arena, international assessments such as the Trends in International Mathematics and Science Study (TIMSS) showed that Malaysian students' average mathematics scores decreased significantly from 519 in 1999 to 411 in 2023, highlighting a long-term decline in mathematical achievement and the urgency of intervention (Halim, 2025).

Motivation

According to Berger and Karabenick (2011), motivation plays a more critical role than mere strategy training **in** mathematics learning. It is essential to cultivate classroom environments that foster students' motivation by offering autonomy that reinforces their self-efficacy. Motivation leads to strategy use, but strategy use does not necessarily lead to more motivation**.** Habibi et al. (2018) demonstrated that integrating multiple forms of representation with generative learning strategies enhances students' autonomy, sense of choice, and intrinsic motivation. This argument is aligned with a study in which the freedom to choose solution strategies was leveraged to promote mathematical flexibility (Low, 2019). Freedom of choice helps students feel more independent in their learning, giving them a sense of autonomy that increases their interest and willingness to engage with the subject.

Hu et. al. (2018) shared the same perception and emphasized the importance of affect, motivation, and engagement in the mathematics learning experience.

There are two general types of motivation: intrinsic and extrinsic motivation. *Intrinsic motivation* refers to the internal desire to learn for personal satisfaction, curiosity, or interest in the subject matter. In contrast, *extrinsic motivation* is driven by external rewards or pressures, such as grades, praise, or fear of failure. Both types of motivation play essential roles in shaping student behavior, but it is a common belief that intrinsic motivation is more effective in promoting deep learning, long-term retention, and academic resilience. Intrinsically motivated students demonstrate higher persistence, hence are more successful, in dealing with difficult tasks. Motivation engenders positive attitude and sustained engagement with mathematical tasks, resulting in positive achievements in mathematics (Singh et al., 2002). However, as Ryan and Deci (2000) noted, most mathematical tasks in academic settings are not “inherently interesting or enjoyable” (p. 55); therefore, extrinsic motivation remains essential for fostering active and volitional engagement in mathematics learning**.**

Self-Determination Theory (SDT), developed by Deci and Ryan (1985), addresses both intrinsic and extrinsic forms of motivation, emphasizing the importance of autonomy in human behavior. SDT suggests that motivation, both intrinsic and extrinsic, is strongest when the individual’s basic psychological needs for autonomy, competence, and relatedness are met. For example, if a student can freely choose between using a worksheet or an online tool to learn mathematics (autonomy), and they succeed in solving problems (competence) and subsequently discuss their answers with friends (relatedness), all three needs are met. SDT shows that when learning environments support these psychological needs, students tend to show greater engagement and improved performance.

The effects of extrinsic motivation in engendering intended behaviors have long been documented (Middleton, 2020). Past studies had associated enhanced mathematical performance with motivation, in general, and extrinsic motivation, in particular (Asanre, 2024; Mondigo & Ucang, 2025; Onyekwere et al., 2018). There are such sources of motivation that enhance mathematics learning as affective care by teachers and classroom instructions (Davadas & Lay, 2018), personal attention and support (Way, 2015), engaging instructional delivery with interested learners (Arthur et al., 2022), engagement with digital resources (Chao et al., 2016), personal belief and value system (Lumsden, 1994), and even self-motivation (Yusof et al., 2020).

Students require motivation to learn mathematics, as it fosters more active and deeper engagement in the learning process. This enhances students’ mathematical performance and strengthens their confidence, ultimately contributing to improved academic outcomes. This study examined the extent to which mathematical learning and performance can be enhanced by granting students autonomy to self-pace their learning and permitting them to leave class upon completing their assigned work.

Instructional Videos for Independent Learning

The rapid advancement of science and technology has significantly shaped the landscape of student learning, influencing both pedagogical approaches and learner engagement.

Teaching and learning are no longer bound by physical co-presence or synchronous timing. Learning can now occur across geographical distances and at flexible times. Today, it is common that students learn asynchronously with digitized learning materials. This trend was particularly fueled by the Covid pandemic, during which physical movement and contact were restricted.

The use of instructional videos in mathematics learning has been studied and found effective. For instance, Riaddin (2022) conducted a meta-analysis to determine the influence of video learning on students' mathematical abilities. The analysis revealed that the use of learning video media, compared with conventional learning media, had a major effect on mathematical ability. Similarly, Jeremias and Carretero (2022) developed experts-validated video lessons and found in a pretest-posttest study that videos facilitated mathematics learning with enhanced performance. Positive findings were also obtained by Villanueva and Alcopra (2025) who employed a purposive sampling method with a quasi-experimental study. It was found that students in the experimental group, who were exposed to video-aided lessons, demonstrated significantly higher performance in mathematics compared to those in the control group. In addition to video lessons, the promotion of collaborative learning further enhanced students' learning and achievement in mathematics (Mohammed & Bello, 2023).

In this study, instructional videos were employed as an intervention to support students' independent learning. In addition, flexible class dismissal was factored in as a motivational strategy. The study aimed to assess changes in students' mathematical performance through the use of video-based learning combined with the motivational strategy of flexible class dismissal.

Current Study

This study, conducted with a small sample and without a control group, explored the effectiveness of independent mathematics learning through instructional videos in the context of flexible class dismissal. The study focused on two mathematical domains: *solving equations* and *solving inequalities*, both of which involved absolute value functions. The participants attempted a pretest and a posttest administered before and after viewing the instructional videos tailored to each mathematical domain. They worked independently at their own pace and left the class upon completing the posttests. In essence, the study examined a learning intervention involving instructional videos, with flexible class dismissal considered as a possible motivational factor.

Past studies and our own experience indicate that students do advance mathematical knowledge by watching videos (Dinar, 2022). This study examined the effect of combining flexible class dismissal as a motivational strategy with video lessons and aimed to answer the question: How does the use of instructional videos, combined with the incentive of flexible class dismissal, affect participants' performance in *solving equations* and *inequalities* involving absolute value functions?

However, the study did not aim to compare learning through video lessons with and without the inclusion of the motivational factor. Should the current study yield positive outcomes, further studies are warranted to examine the extent to which flexible class dismissal influences performance. We postulate that the presence of such a motivational factor will afford learners a sense of autonomy, fostering excitement that may lead to deeper engagement and more effective mathematical performance.

Method

Participants

Twenty-five A-Level students (14 males, 11 females) from a private college voluntarily participated in the study. All participants completed the *Solving Equations* tasks. However, one participant withdrew midway through the activities, leaving only 24 participants to complete the *Solving Inequalities* tasks.

These participants were enrolled in the Cambridge International Advanced Level program at the time of the study. While they were expected to possess foundational knowledge of solving equations and inequalities, the inclusion of absolute value functions might have presented a conceptual challenge.

Design

This study employed a pretest-posttest design to evaluate changes in the participants' performance in *solving equations* and *inequalities* involving absolute value functions, with flexible class dismissal as a motivational strategy. In addition, the participants' solutions were analyzed qualitatively to identify any emerging patterns of change in their solution strategies.

Procedure

The participants were led into a computer laboratory and the study procedure was elaborated. They were required to learn *solving equations* and *inequalities* involving absolute value functions through instructional videos pre-installed on the computers. A pretest and a posttest were administered before and after they watched the instructional videos, for each domain. Despite the recommended activity durations (Table 1), they were required to specify their start and end times for each activity. Throughout the entire learning process, the participants were allowed to seek explanation and raise questions about the video contents.

The highlight was the freedom to learn and accomplish the tasks at their own pace and leave the class flexibly upon completing the posttests. Table 2 shows the mean time spent on the activities.

Material

Table 3 shows the *equations* and *inequalities* administered for the pretests and posttests. The tasks were validated by a seasoned instructor from another institution to confirm that the tasks meet the Cambridge A Level demands.

Solving equations and inequalities involving absolute functions require a solid understanding of the *magnitudes of real values* or the *nature of absolute value functions*, depending on the approach of solution. The tasks expressed in varied forms may require nuanced reasoning to yield diverse interpretations and solutions, which are not immediately discernible, particularly for novice learners.

Table 1
Proposed durations to guide the learning activities

Domain (absolute functions)	Activity	Proposed duration (minutes)
Solving equations	Pretest	5
	Video watching (1)	10
	Posttest	5
Solving inequalities	Pretest	8
	Video watching (6)	34
	Posttest	8

Table 2
Mean time spent on the learning activities (in minutes)

	Activity		
Domain	**Pretest**	**Video watching**	**Posttest**
Solving equations	5.0	10.3	7.3
Solving inequalities	8.0	36.0	8.9

Table 3
Tasks of equations and inequalities

	Solving equations			Solving inequalities	
Task	**Pretest**	**Posttest**	**Task**	**Pretest**	**Posttest**
1	$\|2x-3\| = 9$	$\|4x-1\| = 19$	1	$\|3x+1\| < 2$	$\|4x+3\| < 5$
2	$\|5-4x\| = \|3x+1\|$	$\|3-2x\| = \|5x+1\|$	2	$\|2-5x\| \geq 3$	$\|3x+4\| \geq 5$
3	$\|3x-6\| = 7-5x$	$\|4-3x\| = 5x-9$	3	$\|5+6x\| \leq 7x+9$	$\|2+7x\| \leq 9x-8$
			4	$\|3+5x\| > 7x+5$	$\|7+3x\| > 6-5x$
			5	$\|2x-3\| < \|5+4x\|$	$\|8-2x\| \geq \|3x-6\|$

Analysis
The mean score differences were subject to a Shapiro-Wilk test for normality due to the small sample size. For *solving equations*, n = 25, W =0.0919, p = 0.0538 > 0.05. For *solving inequalities*, n = 24, W = 0.928, p = 0.0929 > 0.05. Both Shapiro-Wilk tests showed insufficient evidence to reject the null hypothesis that the data sets were drawn from a normally distributed population. The mean score differences conform sufficiently to normality, meeting the assumption necessary for a paired sample t-test.

In addition, the participants' solutions to the given tasks and their underlying conceptual understanding were scrutinized to identify any changes from pretest to posttest.

Table 4
Paired-sample t-test comparing scores of pretest and posttest

Domain		**Mean**	**Standard deviation**	***df***	***t* (one-tailed)**	***p***	**Effect size *d***
Solving equations	Pretest	2.23	0.98	24	1.71	< 0.05	0.89
	Posttest	2.99	0.45				
Solving inequalities	Pretest	0.79	0.79	23	1.71	< 0.05	1.58
	Posttest	2.11	0.57				

Results

Quantitative Findings

Table 4 shows the results of the paired *t*-tests. There was a significant difference in scores with large effect for both *solving equations* and *inequalities* before and after instructional video learning driven by the motivating factor of flexible class dismissal.

Qualitative Findings

Participants' solutions exhibited a wide range of errors, procedural or conceptual, including basic algebraic slips, incorrect approaches to solving quadratic inequalities, misinterpretations of equations and inequalities involving absolute value functions, and failure to verify solutions. However, conceptual errors were more prominent in participants' pretest solutions than in their posttest solutions. Figure 1 compares the frequencies of several common errors in participants' pretest and posttest responses, highlighting shifts in performance. More severe are misconceptions in solving inequalities involving absolute value functions, as shown in Figure 2. The misrepresentation of solutions to inequalities clearly reflects the influence of task features rather than sound conceptual understanding. On the whole, misconceptions decreased significantly in posttest responses.

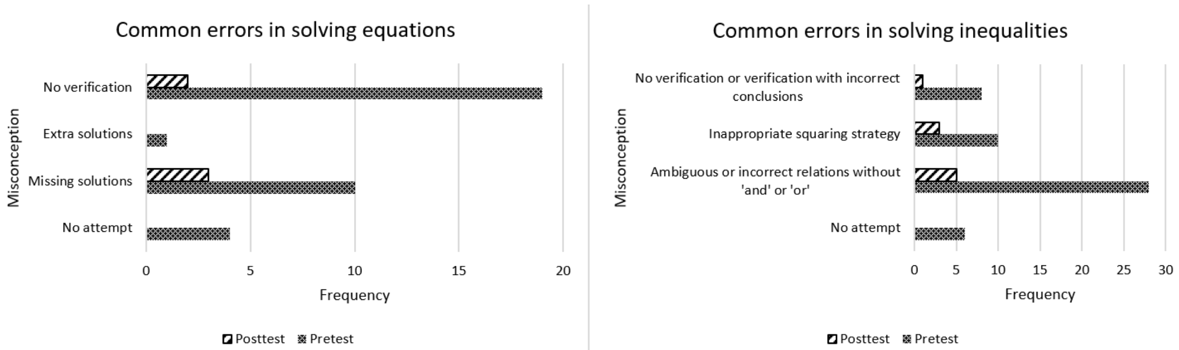

Figure 1: Common errors in participants' solutions

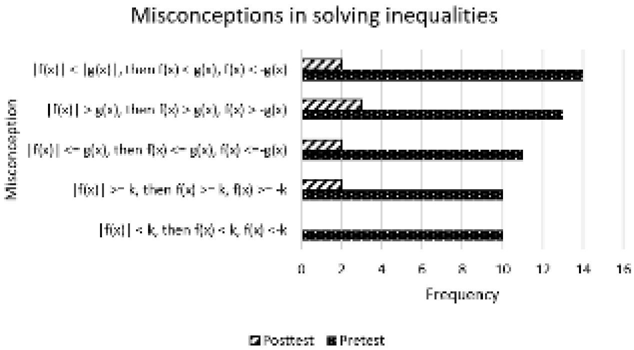

Figure 2: Misinterpretations of inequalities involving absolute value functions

Figures 3 and 4 illustrate the shifts in solution strategies from pretests to posttests. In general, participants were better able to enact more efficient solutions and to be more conscious about verifying their solutions, in addition to enhanced accuracy.

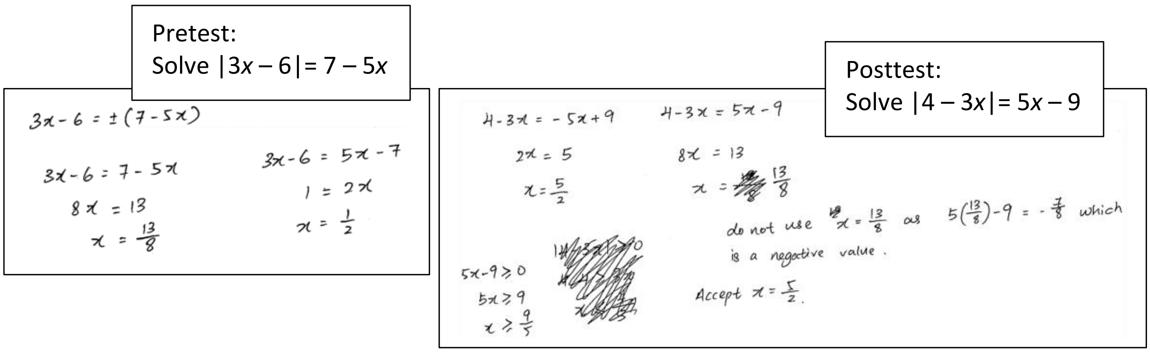

Figure 3: Enhanced conceptual understanding with solution verification

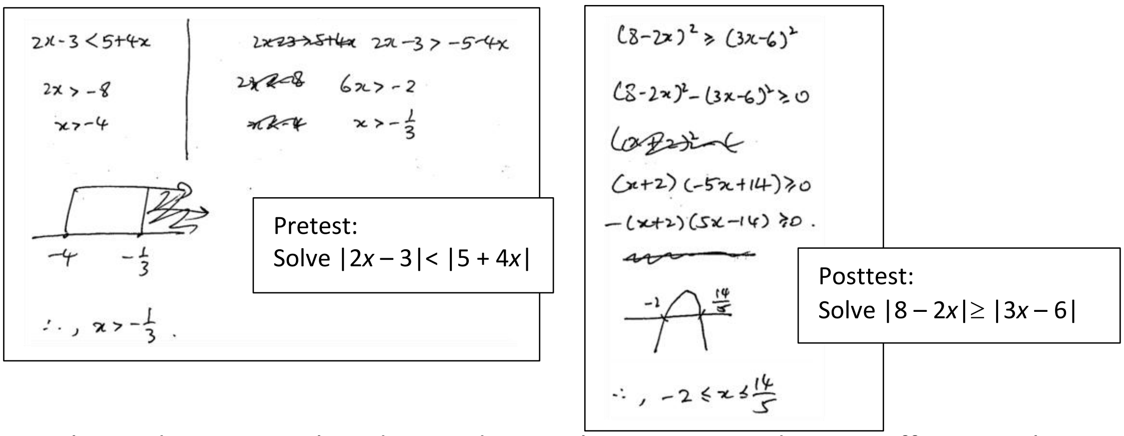

Figure 4: Enhanced conceptual understanding with accurate and more efficient solution strategy

Discussion

This study examined changes in students' performance in *solving equations* and *inequalities* involving absolute value functions, before and after watching instructional videos, motivated by the incentive of flexible class dismissal. The changes in performance were found to be statistically significant, while enhanced solution strategies were notably prominent upon intervention.

The positive results may imply the participants' more intensified focus on learning. The changes in their solution strategies clearly point that they were attentive to nuanced concepts upon intervention. We posit that the participants were excited by the autonomy to learn and end their lesson flexibly at their own pace. These self-determination factors of motivation possibly led to the significant changes in their mathematical performance. While learning through the video lessons, the participants could maneuver forth and back, or pause where necessary, to clarify their thoughts and understanding flexibly, unlike the traditional means of lectures. Their attentiveness to conceptual nuances may have been influenced by the opportunity to leave class flexibly, as no procrastination was observed, their time spent on each activity closely aligned with the recommended guidance.

While video lessons and collaborative learning are each effective on their own, the integration of collaborative learning alongside video instruction significantly enhanced mathematics learning and performance (Mohammed & Bello, 2023). Echoing this perspective, we posit that integrating a motivational component with instructional video lessons can intensify mathematics learning, as evidenced in the present study.

However, the extent to which the motivational factor influenced the intervention and intensified learning remains an open question. The small sample size in this study has limited its external validity. Moreover, it remains uncertain whether similar results could be achieved through instructional videos alone, without the inclusion of the motivational factor. While this study suggests a positive impact from coupling a motivational factor with instructional videos, further experimental and comparative research involving larger sample sizes is needed to establish causal relationships. If such incorporation of motivational factors into classroom learning proves both feasible and effective, teachers may shift away from traditional, unidirectional instruction and instead be freed to support individual learners during class time.

Conclusion

This study suggests that flexible class dismissal, when used as a motivational strategy, can intensify mathematics learning and improve performance through video lessons. While the findings are encouraging, further research is needed to establish the causal relationships influencing mathematical performance.

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