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ABSENTEEISM AND STUDENTS' ATTITUDES TOWARD SCIENCE: IMPACT ON EXAM RESULTS AMONG EIGHTH-GRADE STUDENTS IN MALAYSIA AND SINGAPORE

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Abstract. *Absenteeism and students' attitudes toward science have an impact on the exam results among eighth-grade students in Malaysia and Singapore. This study employed weighted least squares and quantile regression techniques on the Trends in International Mathematics and Science Study (TIMSS) 2019 data to analyze the net effect of these two factors in influencing the academic performance of eighth-grade students. Given Singapore's considerable lead in TIMSS ranking over Malaysia, this research sheds light on modifiable factors that can help Malaysia enhance its national science education. Absenteeism was more pressing in Malaysia than in Singapore, but it significantly influenced exam results in both countries. However, there was no significant difference in attitudes toward science. Results from quantile regression show that these impacts were not uniform across the performance distributions. The study's results emphasize that absenteeism, home educational resources, and parental education contribute to the performance disparities between the two countries. These results underscore the importance for policymakers and educational planners in Malaysia to take proactive steps in addressing these shortcomings to improve students' exam results, to work towards narrowing the performance gap, and to enhance science education.*

Keywords: *home educational resources, quantile regression, science achievement, TIMSS, valuing science*

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Introduction

As societies have increasingly depended on science and technology, global educational systems have prioritized the mastery of science, technology, engineering, and mathematics (STEM) subjects. STEM education is a prerequisite for fostering innovation, driving industrialization, creating jobs, and fueling economic progress. Students' proficiency in these disciplines indicates a nation's educational quality (Kazu & Kurtoğlu Yalçin, 2021; Strelan et al., 2020).

The Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA) are international assessment programs measuring students' academic performance. The TIMSS initiative, conducted once in four years starting in 1995, focuses on evaluating the academic achievements of eighth-grade students (typically 15-year-olds) in mathematics and science. The number of countries in this assessment has risen from 46 to 60 in its latest iteration in 2019. However, the number of participating countries in the eighth-grade assessment has declined from 46 to 39 across the two cycles. On the other hand, the PISA, launched in 2000 and reiterated every three years, evaluates eighth-grade students' proficiency in reading, mathematics, and science. It also gauges students' capacity to apply acquired knowledge in practical, real-world scenarios. The number of countries participating in PISA has grown from 41 initially to 78 in the 2018 cycle.

Several studies on students' performance in science have been conducted using data from TIMSS and PISA (Jiang et al., 2023; Kiliç Depren, 2020; Lay & Chandrasegaran, 2018; Lay & Ng, 2021; Özkan & Tekeli, 2021; Shannag et al., 2013; Tang et al., 2022). Some deal with international comparisons (Aşkın & Öz, 2020; Geske & Kangro, 2002; Lay & Chandrasegaran, 2018).

This study uses TIMSS 2019 data to analyze the factors affecting the academic performance of eighth-grade students in Malaysia and Singapore to stimulate discourse on the improvements in science education and enhance equity based on empirical evidence. Both nations have invested substantially in education to cultivate human capital and drive economic growth. With a

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mean science score of 608, Singapore's students have been ranked consistently as the top performers, while Malaysia with a mean science score of 460 was placed at 29 out of 39 participating countries in 2019. Hence, exploring the gross and net effects of factors influencing science performance in both countries can provide insights to guide Malaysia in improving its national science education. While there was a comparative study in Malaysia and Singapore on teacher preparation on students' science achievement (Lay & Chandrasegaran, 2018) and one on the comparison of school climate on science achievement among South-East and East Asian countries (Lay & Ng, 2021), to our knowledge, there is no study comparing the impacts of absenteeism and students' attitudes toward science on exam results among students in the two neighboring countries.

Literature Review

A multitude of factors influence students' science achievement. There is ample evidence that absenteeism and students' attitudes toward science are among the key factors influencing their science achievement (Akkus & Çinkir, 2022; Arulampalam et al., 2012; Keppens, 2023; Klein et al., 2022; London et al., 2016). These studies support the faucet theory, which posits that frequent exposure to schooling improves students' skills, and the school disengagement theory on why absenteeism might lead to lower academic achievement (Alexander et al., 2001; Keppens, 2023).

Absenteeism is associated with the socio-economic background of students. One study has found that students with a disability and the impoverished were the most likely to have missed school (García & Weiss, 2018). Several studies have found that the main reasons for skipping classes include poverty, lack of parental guidance and support, lack of interest, unconducive classrooms, poor teacher approach, substance abuse, punishment at school, ineffective Parent Teacher Association, and the mushrooming of entertainment and video centers (Center for Research in Education and Social Policy, 2018; García & Weiss, 2018; Moonie et al., 2008). Student absenteeism also challenges teachers as they have difficulty in classroom management and waste time repeating lessons for the absent students (Akkus & Çinkir, 2022).

The significance of students' attitudes toward science cannot be overstated, as these attitudes shape their engagement, motivation, and dedication to science-related activities. These attitudes and behaviors can either facilitate or hinder the learning process, which affects their science performance. The underpinning theoretical rationale for the importance of attitudes toward STEM subjects finds support in various theories encompassing educational, social, and vocational psychology. Notably, Eccles' expectancy-value theory provides a robust framework, positing that attitudes, including perceptions of success and task value, alongside self-concept, greatly influence educational decisions (Else-Quest et al., 2013).

The impact of positive attitudes toward STEM subjects extends to creating an enriching and receptive learning environment. Conversely, negative attitudes can culminate in disinterest and suboptimal learning outcomes. The correlation between attitudes and achievements in science has recently garnered heightened attention within the research community. Numerous investigations have unveiled a positive association between favorable attitudes toward science and exam results, consistent with hypotheses (Al-Mutawah & Fateel, 2018; Ali et al., 2015; Aşkın & Öz, 2020; Chang & Cheng, 2008; Else-Quest et al., 2013; Mao et al., 2021). Juan Andrea et al. (2014) have found that all three science attitudinal indices of enjoyment, valuing science, and self-confidence in learning science have contributed significantly to grade 9 learners' science scores. However, results from a meta-analysis have shown that the type of attitude has moderated a positive correlation between attitudes toward science and learning outcomes (Mao et al., 2021).

Several studies also found a positive association between self-efficacy and science achievement (Aşkın & Öz, 2020; Juan et al., 2018; Kirbulut & Uzuntiryaki-Kondakci, 2019; Lam & Lau, 2014; Larson et al., 2013). Students who are confident in science tend to do well in the subject. Louis and Mistele (2012) have found a statistically significant gender difference among science subjects after controlling for self-efficacy. Besides, students with higher educational goals tend to perform better than less ambitious students (Aşkın & Öz, 2020). These findings call for more intervention strategies on non-cognitive aspects to enhance science learning.

Absenteeism is often a symptom of broader socio-economic challenges (Sosu et al., 2021). When exploring the repercussions of absenteeism and students' attitudes toward science on their academic achievements, it becomes evident that factors such as family background, socio-economic status, parental education, parental involvement, and home educational resources also wield substantial influence over students' educational outcomes, which must be considered. Family background and socio-economic status profoundly impact a student's access to resources,

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opportunities, home environment, and support networks. Research indicates that family scholarly culture, encompassing parents' education and the number of books in the home, correlates positively with educational success across diverse economic contexts (Aşkın & Öz, 2020; Evans et al., 2010).

Students from varying socio-economic backgrounds often encounter disparities in exposure to educational materials, technology, and enriching extracurricular activities. These discrepancies can subsequently impact their engagement with science and overall academic performance, as evidenced by prior studies (Ferguson et al., 2007; Fergusson et al., 2008; Khan et al., 2019; Li et al., 2020; Li & Qiu, 2018; Sirin, 2005). Instances also arise where students miss classes due to illness or to assist with domestic responsibilities and their parents' work (Keppens, 2023; Klein et al., 2022).

Parental education and involvement emerge as critical determinants that can either enhance or impede a student's affinity for science and attendance at educational institutions. Parents with higher educational levels are more likely to recognize the significance of a solid scientific foundation and can facilitate their children's learning experiences. Furthermore, positive role models and ongoing discussions about the value of education can cultivate a culture of learning within the household, reinforcing a student's commitment to school attendance and excellence in science-related subjects. Several studies highlight that the higher educational levels of both parents have positively correlated with their children's academic achievements (Abu Bakar et al., 2017; Davis-Kean, 2005; Idris et al., 2020; Murnane et al., 1981). Intriguingly, one study has noted that while mothers' education positively impacts students' academic outcomes, the reverse is true for working women, except those who are teachers (Hoque et al., 2017).

Furthermore, the depth of parental involvement, characterized by interactions with teachers, encouragement of curiosity, and provision of learning resources at home, has significantly molded students' motivation to embrace science and sustain consistent engagement in their studies. Research has demonstrated that parental involvement positively impacts students' academic performance (Fan & Chen, 2001; Lara & Saracostti, 2019).

School resources have also been found to affect students' exam results (Hanushek, 1997; Ndlovu, 2018). Graddy and Stevens (2005) found that the student-teacher ratio at a school is negatively correlated with students' exam results. Moreover, school resources have been found to reduce the socio-economic achievement gap in PISA (Yang & Lee, 2022).

Research Problem

Beyond imparting knowledge about the natural world, science education nurtures vital skills like critical thinking, problem-solving, and analytical reasoning. The emphasis on STEM education is typically initiated at the secondary educational level because this stage is crucial in determining a student's academic trajectory.

Given the importance of STEM education, there is a need for a comprehensive assessment of students' achievements in these subjects and their influencing factors. By understanding the factors that impact science performance, educational policymakers and stakeholders can identify areas for improvement in their respective education systems. This knowledge could lead to targeted interventions that enhance the quality of science education and subsequently improve students' scientific literacy and competency.

Many studies have analyzed the impacts of absenteeism and students' attitudes toward science on academic performance; only a few have utilized a nationally representative sample. Because chronic absenteeism is not well researched (London et al., 2016), this study examines the impact of the frequency of class absence on academic performance to address this gap. Moreover, the effects of absenteeism on performance may differ by gender, socio-economic status, and student ability (Arulampalam et al., 2012; Mooney et al., 2023). Using quantile regression analysis, Arulampalam et al. (2012) have found that absenteeism's effects on academic performance are much more pronounced among better-performing students. There needs to be more research addressing the multifaceted impacts of various factors on the diverse range of examination outcomes. Hence, this study enhances the methodological toolkit for investigating educational disparities by incorporating weighted least squares and quantile regression methods.

Research Focus

This analysis primarily focuses on the impacts of absenteeism and students' attitudes toward science on exam results. These factors are central due to their direct influence on engagement, measurability, potential for interven-

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tions, alignment with educational goals, research support, and contribution to a comprehensive understanding of science education. Moreover, absenteeism is widely recognized as a significant factor associated with poorer academic outcomes, especially in science subjects, which typically involve hands-on experiments, interactive discussions, and practical sessions. Also, science subjects are cumulative, where concepts build upon each other, and hence, missing even a single class can make catching up difficult.

The analysis of the impacts of absenteeism and students' attitudes holds the potential to refine theoretical frameworks for explaining variations in exam results. It is essential to emphasize that this analysis considers several other factors commonly considered in educational research, including but not limited to home educational resources, parents' educational levels, and school resources. These factors are primarily included as control variables to ascertain the net effect of absenteeism and students' attitudes toward science on the exam results.

Research Aim

The study aimed to assess the impact of absenteeism and students' attitudes toward science on exam performance across two countries characterized by a significant performance gap. The analysis has the potential to make substantial contributions to the existing literature, enrich educational theories, and guide evidence-based policies for enhancing educational outcomes and narrowing disparities. Examining two countries with a notable gap in science performance adds a novel dimension to the literature. Findings from this study could shed light on factors contributing to divergent outcomes, offering insights applicable to other educational contexts.

Research Methodology

General Background

The data for this study were extracted from the most recent iteration of the TIMSS, conducted in 2019 in Malaysia and Singapore. TIMSS, overseen by the International Association for the Evaluation of Educational Achievement (IEA)'s TIMSS & PIRLS International Study Center at Boston College, is a widely acknowledged assessment. Following international protocols and TIMSS' standards of technical excellence, each participating country appointed a National Research Coordinator responsible for supervising the execution of TIMSS. In conducting TIMSS, IEA has adopted various quality control mechanisms to ensure high-quality data that are valid and reliable (Wagemaker, 2020). This study is based on large samples in Malaysia and Singapore, and the surveys were conducted using scientific methods that have been tested in many countries and over many cycles.

Sample

Each country employed a two-stage stratified sampling design to ensure a representative sample of schools and students on a national scale. The initial sampling phase encompassed the selection of schools based on probability proportional to their size from a list of eligible schools. In Malaysia, stratification involved school type, score level within the Ministry of Education (M.O.E.) daily school strata, and urbanization (rural or urban) within all M.O.E. strata. In contrast, being entirely urban, Singapore did not require such stratification. A total of 177 schools were chosen in Malaysia, while Singapore selected 153.

The subsequent sampling stage involved selecting intact classes from the eighth grade of each chosen school through systematic sampling, maintaining an equal probability of selection. Each National Research Coordinator used the Within-School Sampling Software (WinW3S), developed by IEA Hamburg and Statistics Canada, to facilitate class sampling. All students within the selected classes participated in the assessment. In Malaysia, 7,065 students completed the assessment, resulting in a student participation rate of 98%. Meanwhile, 4,853 students in Singapore completed the assessment, with a student participation rate of 96%. A detailed explanation of the methods and procedures is available from TIMSS' technical report (Martin et al., 2020).

Instrument and Procedures

For comprehensive data collection, four distinct sets of questionnaires were prepared: the student questionnaire, teacher questionnaire, school questionnaire, and curriculum questionnaire. These questionnaires were

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completed by the eighth-grade students and their parents, teachers, and school principals. The student questionnaire, serving as the basis for this analysis, comprises 27 main questions, each containing various sub-questions, yielding 131 questions/sub-questions.

Data Analysis

This study's primary dependent variable was the science scores attained by eighth-grade students, assessed using a ratio scale. The TIMSS science scores were constructed using the mean of the five plausible values, representing the proficiency variables drawn from the resulting posterior distribution for each student in each cognitive domain. These scores ranged from a minimum of 133.2 in Malaysia to a maximum of 824.4 in Singapore.

The two independent variables for this analysis were the "Frequency of absence from school" and "Students value science." Absenteeism refers to a student being absent from school for various reasons such as lack of motivation to study, ill health, having to work during school hours and taking care of sick family members, and poor relationships with other students. The frequency of absenteeism was coded as 1 = Once a week; 2 = Once every two weeks; 3 = Once a month; 4 = Once every two months; and 5 = Never or almost never. "Students value science" was coded as 1 = Strongly value science, 2 = Somewhat value science, 3 = Do not value science. This variable was derived from responses to nine Likert-scale questions regarding students' attitudes toward valuing science. The other independent variables in this analysis were home educational resources, parents' highest educational level, and "affected by science resource shortage." Home educational resources variable was coded as 1 = Many, 2 = Some, and 3 = Few. Parents' highest educational level was coded as 0 = Do not know, 1 = University or higher, 2 = Post-secondary, 3 = Upper-secondary, 4 = Lower-secondary, and 5 = Some primary or none. "Affected by science resource shortage" was coded as 1 = Not affected, 2 = Affected, and 3 = Affected a lot.

Two attitudinal variables, "Students like learning science" and "Students confident in science," are closely correlated with "Students value science" and hence were not included in the analysis for the sake of parsimony. Contrary to expectation, an initial examination of the data revealed that the variables "Time spent on science subjects" and attendance of extra classes do not exhibit significant correlations with science scores, and the signs are not always consistent and are therefore not included in the analysis.

All analyses were performed using SPSS version 29. Data were weighted using the overall sampling weight to ensure the findings accurately represented the population of eighth-grade students in each respective country. The overall sampling weight for each student was the product of the three weighting components: school, class (within school), and student (within class).

The analysis began by presenting the mean science scores categorized across different independent variables. Subsequently, weighted least squares regression analysis was conducted to investigate the relationships between the independent variables and science exam results before and after accounting for other variables in the model. The weighted least squares regression coefficients were employed to quantify the magnitude and direction of these relationships. The investigation encompassed five distinct regression models, each focused on Malaysia and Singapore separately. The first two models individually evaluated the influence of school absence frequency and students' valuing of science on the exam results. The third model examined the combined impact of these two factors while controlling for one another. Additionally, Model Four introduced home educational resources and parents' educational levels as supplementary controls. In the fifth model, the effects of each independent variable were assessed while considering all other variables in the model, including the presence of science resource shortages.

Moreover, quantile regression was independently conducted for Malaysia and Singapore to provide insights into the conditional distribution of the exam score at various quantiles. This approach aimed to estimate the conditional quantiles of exam results based on the predictor variables. As the effects of predictors can differ across various score ranges, quantile regression provides a more comprehensive understanding of how absenteeism, valuing science, and other predictors influence students at different performance levels. This analysis strategy allows for a nuanced comprehension of the relationships in situations where conventional ordinary least squares regression might not fully capture the variation across performance levels.

The significance of the weighted least squares and quantile regression coefficients was based on the *t*-test. The cut-off value used to evaluate the significance is $p < .05$.

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Research Results

Bivariate Relationship between the Independent Variables and the Exam Scores

Table 1 presents the distribution of samples of the key study variables in Malaysia and Singapore. It also shows the mean score in the science subject and the standard errors for these estimates. The data indicates a notable difference between Malaysian and Singaporean students concerning class attendance – Malaysian students were significantly more likely to be absent than their Singaporean counterparts. Specifically, among the Malaysian students in this study, as high as 17% were absent from class at least once a week (or chronic absence), compared to only 2.3% among the Singaporean students. Conversely, 74.9% of Singaporean students were never or rarely absent from class, compared to 40.2% of Malaysian students.

In both countries, absenteeism significantly impacts students' performance in science. In Malaysia, the average score ranged from 386 among students absent at least once a week to 492 among those who were hardly ever absent or never absent. In Singapore, the corresponding figures were 476 and 620 respectively.

Most students in both countries strongly value science, with a notable proportion holding strong positive attitudes toward the subject (Table 1). Students valuing science is positively associated with their exam results, as evidenced by the science scores, ranging from 384 to 492 in Malaysia and 557 to 632 in Singapore.

Singaporean students are better equipped with home educational resources than Malaysian students. Specifically, 14.3% of Singaporean students have access to many home educational resources, whereas only 4.4% of Malaysian students enjoy the same resources. Conversely, relatively more Malaysian students, 20.5%, have limited access to educational resources at home, while only 8.1% of Singaporean students face a similar situation.

The availability of home educational resources significantly impacts students' science achievement in both countries. In Malaysia, students with limited access to such resources obtained an average score of 413, while those with ample resources at home scored much higher, averaging 549. Similarly, in Singapore, students with few home educational resources achieved an average score of 525, whereas those with abundant resources scored significantly higher, averaging 659.

Among the surveyed students, 65% to 70% reported their parents' educational levels. The data revealed that Singaporean parents generally had a higher education than Malaysian parents. Notably, 51% of Singaporean parents held tertiary education degrees, while only 15% of Malaysian parents achieved the same level of education (among those who reported). In Malaysia, the most common educational level among parents was upper-secondary and post-secondary education, which constituted 65% of the surveyed population.

The impact of parents' educational attainment on students' science achievement was evident from the results. There was a significant gap of over 100 points in the science scores between students whose parents had some primary education and those whose parents had tertiary education – ranging from 416 to 531 in Malaysia, and from 524 to 648 in Singapore.

Regarding school science resource availability, Malaysian schools are significantly more prone to facing shortages than their Singaporean counterparts. Nearly all schools in Malaysia grapple with science resource shortages; a substantial 20.4% experience severe shortages. In contrast, only a quarter of schools in Singapore encounter resource shortages, with less than 7% facing acute shortages.

Surprisingly, despite these disparities in resource availability, this factor did not have a discernible and consistent effect on students' science achievement in both countries. The impact of resource shortages on academic performance in science subjects was not evident, suggesting that other factors might be at play in shaping students' achievements in this area.

It is essential to acknowledge that the estimates presented here were based on a large sample size, which resulted in very small standard errors. This fact strengthens the reliability and robustness of the findings. However, it is worth mentioning that there were a few categories within the independent variables with relatively smaller sample sizes in Singapore. These categories included students absent at least once a month, parents with low educational levels, and schools facing acute resource shortages. Due to the smaller sample sizes, these specific categories exhibited relatively larger standard errors in their estimates. Nonetheless, these standard errors did not exceed 3.2 even in the worst-case scenario, indicating that the estimates remain reasonably stable and dependable.

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Table 1
Sample Characteristics, Mean Science Score, Standard Error of the Mean, Malaysia and Singapore

Variables	Malaysia (n = 7,065)			Singapore (n = 4,853)		
	Sample distribution (%)	$\bar{X}$	*SE*	Sample distribution (%)	$\bar{X}$	*SE*
Frequency of absence						
Once a week	17.0	386.48	0.30	2.3	476.14	3.02
Once every 2 weeks	10.3	433.84	0.40	3.0	535.90	2.61
Once a month	14.3	460.05	0.34	6.7	563.18	1.72
Once every 2 months	18.3	474.91	0.30	13.1	597.70	1.26
Never or almost never	40.2	492.46	0.22	74.9	620.43	0.45
Students value science						
Strongly value science	44.8	492.41	0.19	41.6	632.04	0.60
Somewhat value science	46.2	445.31	0.21	47.6	597.61	0.63
Do not value science	9.0	383.67	0.48	10.8	557.44	1.29
Home educational resources						
Many	4.4	548.76	0.54	14.3	658.70	0.82
Some	75.0	468.53	0.16	77.6	606.82	0.47
Few	20.5	412.54	0.30	8.1	524.58	1.65
Parents' education						
Don't know	35.0	440.93	0.25	30.0	591.55	0.80
University or higher	9.5	531.14	0.39	35.7	648.21	0.56
Post-secondary	16.4	491.60	0.33	20.3	588.43	0.94
Upper-secondary	25.9	463.27	0.27	8.9	583.25	1.34
Lower-secondary	8.1	424.82	0.48	2.6	548.96	3.17
Some primary or none	5.2	416.13	0.56	2.5	524.33	2.93
Science resource shortage						
Not affected	2.3	490.93	1.31	75.4	607.31	0.51
Affected	77.3	454.18	0.16	17.9	606.78	0.87
Affected a lot	20.4	478.91	0.33	6.7	612.35	1.81

Note: Missing values are excluded from the calculations.

Table 2 presents data on the percentage of Malaysian and Singaporean students who skipped classes at least once a month, categorized by various factors. Notably, Malaysian students exhibited a strikingly higher tendency to skip classes, surpassing their Singaporean counterparts by more than threefold (41.6% compared to 12%).

Within Malaysia, a substantial gender disparity emerged, with boys showing a significantly greater propensity to skip classes than girls. However, in Singapore, this gender divide in class attendance was not statistically significant.

Across both countries, the frequency of class skipping exhibited significant associations with several key factors: students' lack of appreciation for science, absence of aspirations for higher education, and limited access to educational resources and support at home. Furthermore, students from families with lower parental educational levels and those residing in economically disadvantaged areas were found to be more prone to skip classes.

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Table 2
Percent of Students Who Were Absent At Least Once a Month in Malaysia and Singapore

Variables	Malaysia (*n* = 7,065)	Singapore (*n* = 4,853)
Overall	41.6	12.0
Gender		
Girl	36.7	12.2
Boy	46.6	11.9
Students value science		
Strongly value science	34.8	10.0
Somewhat value science	46.6	12.9
Do not value science	47.7	15.8
How far in education one expects to go		
Secondary education	54.8	26.9
Post-secondary, non-tertiary education	49.2	28.6
Short-cycle tertiary education	43.0	16.5
Bachelor's or equivalent level	30.7	8.8
Postgraduate degree	26.8	8.9
Home educational resources		
Many	20.1	6.1
Some	39.8	11.8
Few	52.5	24.6
Home educational support		
Neither own room nor internet connection	47.9	23.2
Either own room or internet connection	43.5	13.8
Both	39.1	10.7
Parents' education		
Don't know	46.0	11.8
University or higher	27.2	8.2
Post-secondary	33.1	13.9
Upper-secondary	42.9	16.7
Lower-secondary	49.8	23.6
Some primary or none	43.7	25.8
Affluence		
0 to 10%	47.8	17.3
11 to 25%	40.0	11.1
26 to 50%	31.1	9.4
More than 50%	21.2	9.5

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Results from Weighted Least Squares Regressions

The weighted least squares regression results on the Malaysian students revealed the following findings: Absenteeism alone accounted for 16.9% of the variance in science scores. In comparison, students' valuing of science explained 12.6% of the variance (Table 3). They explained 26.1% of the variance when both variables were considered together. However, with the addition of home educational resources and parents' educational level to the model, the adjusted coefficient of determination increased substantially to 33.3%. Interestingly, including school science resource shortage increased the explanatory power only slightly to 34.2%.

Upon further investigation, adjusting for students' valuing of science reduced the gap between those who were absent at least once a week and those who were hardly or never absent slightly, from about 106 points to 97 points—including home educational resources and parents' educational level in the model further narrowed the gap to 85 points. The addition of school resource shortage had a negligible effect on the gap.

Similarly, the gap between students who did not value science and those who strongly valued it diminished from 109 points to 96 points after adjusting for absenteeism. Including home educational resources and parents' educational levels in the model decreased the gap to 84 points. Once again, the school science resource shortage did not impact the gap.

Among the other independent variables, home educational resources and parents' educational level emerged as significant predictors of students' science achievement. Students with access to abundant educational resources scored about 61 points higher than those with limited resources, even after controlling for absenteeism, valuing science, and parents' educational level. Additionally, students whose parents had attained tertiary education scored 57 points higher than those whose parents had only completed primary education, even after accounting for other variables in the model. However, school science resource shortage did not have a consistent effect on the exam results. Therefore, in the interest of simplicity and conciseness, Model 4 best elucidates the factors influencing the science exam results among eighth-grade students.

Table 3
Weighted Least Squares Regression Coefficients (Standard Errors), Malaysia (n = 7,065)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Frequency of absence					
Once a week	-105.96***		-96.68***	-85.22***	-84.32***
	(0.38)		(0.37)	(0.36)	(0.36)
Once every 2 weeks	-58.60***		-54.78***	-48.08***	-47.28***
	(0.46)		(0.44)	(0.43)	(0.42)
Once a month	-32.39***		-31.30***	-28.47***	-27.61***
	(0.41)		(0.39)	(0.37)	(0.37)
Once every 2 months	-17.53***		-18.76***	-17.63***	-17.42***
	(0.38)		(0.36)	(0.34)	(0.34)
Never or almost never (ref)					
Students value science					
Strongly value science		108.72***	96.43***	84.44***	85.14***
		(0.50)	(0.46)	(0.45)	(0.45)
Somewhat value science		61.63***	58.79***	53.32***	53.47***
		(0.50)	(0.46)	(0.44)	(0.44)
Do not value science (ref)					
Home educational resources					
Many				61.41***	59.60***
				(0.73)	(0.73)
Some				26.53***	26.23***
				(0.36)	(0.36)

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Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Few (ref)					
Parents' education					
Don't know				10.09***	9.43***
				(0.63)	(0.62)
University or higher				57.32***	55.31***
				(0.76)	(0.75)
Post-secondary				34.74***	33.33***
				(0.69)	(0.69)
Upper-secondary				22.34***	21.05***
				(0.65)	(0.64)
Lower-secondary				2.43***	1.95**
				(0.69)	(0.69)
Some primary or none (ref)					
Science resource shortage					
Not affected					13.69***
					(0.85)
Affected					-20.12***
					(0.30)
Affected a lot (ref)					
Constant	492.46***	383.70***	420.57***	382.52***	398.39***
	(0.21)	(0.46)	(0.45)	(0.68)	(0.72)
R^2	.169	.126	.262	.333	.342
Adj. R^2	.169	.126	.261	.333	.342
F test statistic	20,523.60	28,909.12	23,557.05	15,091.57	13,583.38
(p)	< .001	< .001	< .001	< .001	< .001

Note: ***$p < .001$, **$p < .01$

In Singapore, absenteeism accounts for 11.3% of the variance, while students' valuing of science explains 7.9%. Combining these two factors explains 18.4% of the variance in science scores. Adding students' access to home educational resources and parents' education to the model raises the adjusted coefficient of determination to 30.2%. However, adding school science resource shortage does not contribute any explanatory power to the model (Table 4). It is worth noting that the percentages of variance explained by the variables in Singapore are lower than those in Malaysia, partly due to a smaller sample size and a skewed distribution in the independent variables.

The impact of absenteeism on science achievement remains relatively consistent even when considering students' valuing of science. For instance, the disparity in science scores between those frequently absent (at least once a week) and those rarely or never absent would only slightly diminish from 144 points to 141 points. However, the influence of absenteeism on science achievement is significantly reduced when considering students' access to home educational resources and parents' education. In this case, students who were absent weekly scored 118 points lower than those who were rarely or never absent from class.

Students' perception of the science subject is also significant in determining their exam results. If there were no difference in absenteeism, students who highly value science would have scored 71 points higher than those who do not value it, a slight reduction from the observed 75-point difference. Moreover, when considering access to home educational resources and parents' educational level, this difference is further reduced to 56 points.

Access to home educational resources and parents' educational achievement are also significant predictors of students' science achievement. After controlling for absenteeism, students' valuing of science, and parents' educational level, students with access to abundant resources would have scored 74 points higher than those who

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had limited resources. Additionally, students whose parents had tertiary education would have achieved 48 points higher than those with only primary education, even after adjusting for other variables in the model. The shortage of school science resources does not influence students' exam results, as indicated by its lack of a significant association with exam performance. Furthermore, it plays no part in improving the model's explanatory power or moderating the effects of other variables on the exam results. Hence, Model 4 is the best model for this study.

Table 4
Weighted Least Squares Regression Coefficients (Standard Errors), Singapore (n = 4,853)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Frequency of absence					
Once a week	-144.48*** (2.75)		-141.08*** (2.64)	-118.10*** (2.48)	-117.96*** (2.48)
Once every 2 weeks	-84.35*** (2.39)		-81.47*** (2.30)	-63.62*** (2.15)	-63.52*** (2.15)
Once a month	-57.23*** (1.64)		-52.41*** (1.58)	-47.15*** (1.47)	-47.16*** (1.47)
Once every 2 months	-22.74*** (1.22)		-22.38*** (1.17)	-19.52*** (1.09)	-19.43*** (1.09)
Never or almost never (ref)					
Students value science					
Strongly value science		74.67*** (1.42)	70.88*** (1.34)	56.19*** (1.26)	56.31*** (1.26)
Somewhat value science		40.14*** (1.40)	38.73*** (1.32)	32.31*** (1.23)	32.44*** (1.23)
Do not value science (ref)					
Home educational resources					
Many				73.83*** (1.96)	73.74*** (1.96)
Some				51.98*** (1.62)	51.80*** (1.63)
Few (ref)					
Parents' education					
Don't know				11.70*** (2.66)	11.92*** (2.66)
University or higher				47.81*** (2.76)	48.11*** (2.76)
Post-secondary				4.62 (2.78)	4.81 (2.78)
Upper-secondary				10.60*** (2.83)	10.74*** (2.83)
Lower-secondary				2.40 (3.24)	2.77 (3.24)
Some primary or none (ref)					
Science resource shortage					
Not affected					-1.54 (1.47)
Affected					1.28 (1.65)

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Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Affected a lot (ref)					
Constant	620.41*** (0.47)	557.43*** (1.26)	571.98*** (1.23)	505.96*** (2.53)	506.68*** (2.85)
R^2	.113	.079	.184	.302	.302
Adj. R^2	.113	.079	.184	.302	.302
F test statistic	1,224.57	1,652.72	1,435.24	1,270.33	1,101.78
(p)	< .001	< .001	< .001	< .001	< .001

Note: ***p < .001

Results from Quantile Regressions

Absenteeism significantly adversely impacted science exam performance among Malaysian students across all quantiles, being more pronounced at higher quantiles. For instance, at the q10 quantile, students who skipped classes at least once a week scored 77.9 points lower than their peers who rarely or never missed classes after controlling all other variables in the model. This gap widened in the q75 and q90 quantiles, with differences of 89.4 and 88.7 points, respectively, compared to the reference group (Table 5).

Students' perception of science also significantly impacted their science scores, which had a more pronounced effect at the lower quantiles than at higher quantiles. At q10, those who strongly valued science scored 101.7 points higher than those who did not value science after accounting for the influence of other variables. However, this difference diminished to 62.9 points at q90.

Home educational resources and parents' education also significantly impacted science performance, particularly at the lower quantiles. For example, those with access to abundant resources scored 73.9 points higher at q10, decreasing to 53.6 points at q90. Similarly, students whose parents had university education scored 71.5 points higher than those whose parents had only some primary education at q10, but the gap reduced to 44.8 points at q90.

Students from schools unaffected by science resource shortages performed significantly better than those facing shortages across all quantiles except q25. However, it is worth noting that the disparity in science performance between those from schools severely affected by resource shortages and those from schools moderately affected was contrary to expectations.

Table 5
Quantile Regression Coefficients (Standard Errors), Malaysia (n = 7,065)

Variables	q10	q25	q50	q75	q90
Frequency of absence					
Once a week	-77.90*** (0.74)	-85.38*** (0.51)	-87.37*** (0.44)	-89.41*** (0.46)	-88.66*** (0.51)
Once every 2 weeks	-50.34*** (0.88)	-43.49*** (0.61)	-48.93*** (0.52)	-49.75*** (0.54)	-56.78*** (0.60)
Once a month	-25.08*** (0.77)	-26.73*** (0.53)	-24.35*** (0.45)	-35.15*** (0.47)	-37.62*** (0.52)
Once every 2 months	-11.37*** (0.70)	-13.21*** (0.49)	-15.94*** (0.42)	-23.84*** (0.43)	-20.35*** (0.48)
Never or almost never (ref)					
Students value science					
Strongly value science	101.68*** (0.93)	95.11*** (0.64)	86.92*** (0.55)	73.75*** (0.57)	62.93*** (0.63)

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Variables	q10	q25	q50	q75	q90
Somewhat value science	56.75***	55.96***	55.89***	49.00***	43.42***
	(0.91)	(0.63)	(0.54)	(0.56)	(0.62)
Do not value science (ref)					
Home educational resources					
Many	73.87***	62.85***	50.45***	51.60***	53.55***
	(1.50)	(1.04)	(0.89)	(0.93)	(1.02)
Some	31.13***	26.28***	19.67***	24.35***	26.12***
	(0.75)	(0.52)	(0.44)	(0.46)	(0.51)
Few (ref)					
Parents' education					
Don't know	9.04***	7.12***	17.70***	6.44***	9.91***
	(1.29)	(0.89)	(0.76)	(0.79)	(0.88)
University or higher	71.45***	60.34***	64.87***	45.70***	44.75***
	(1.56)	(1.08)	(0.92)	(0.96)	(1.06)
Post-secondary	33.68***	36.81***	45.66***	32.16***	27.80***
	(1.43)	(0.99)	(0.84)	(0.88)	(0.97)
Upper-secondary	28.34***	22.45***	29.64***	18.48***	16.33***
	(1.33)	(0.92)	(0.79)	(0.82)	(0.91)
Lower-secondary	3.14*	2.71**	9.64***	-3.23***	1.94*
	(1.42)	(0.99)	(0.84)	(0.88)	(0.97)
Some primary or none (ref)					
Science resource shortage					
Not affected	4.18*	-7.88***	16.07***	27.34***	53.04***
	(1.75)	(1.21)	(1.04)	(1.08)	(1.19)
Affected	-13.00***	-18.88***	-20.33***	-20.23***	-20.51***
	(0.63)	(0.44)	(0.37)	(0.39)	(0.43)
Affected a lot (ref)					
Constant	275.08***	341.72***	396.13***	465.81***	513.37***
	(1.48)	(1.03)	(0.88)	(0.91)	(1.01)

Note: ***$p < .001$, **$p < .01$, *$p < .05$

Compared to Malaysian students, the frequency of skipping classes among Singaporean students had an even more significant impact on their science exam results across all quantiles after controlling for other variables in the model. The influence of absenteeism on exam results was most pronounced at q25 and q50 but less at q90. At q25, students who were absent at least once a week scored 135.7 points lower than those who rarely or never skipped classes (Table 6). However, absenteeism is rare among Singaporean students compared to their Malaysian counterparts.

On the other hand, Singaporean students' perception of science had a more negligible impact on their science performance than their Malaysian counterparts, a pattern observed across all quantiles. The impact of students' science perception was most pronounced at q25 and least pronounced at q90 after accounting for other variables in the model.

Educational resources had a much more substantial impact on students' science performance in Singapore than in Malaysia, especially at the lower quantiles. At q10, Singaporean students with access to abundant home resources scored 107.6 points higher than those with limited resources, but this difference fell to 50.2 points at q90. Moreover, the impact of parents' education on students' science performance was more noticeable at the lower quantiles than at the higher quantiles.

Surprisingly, students from schools severely affected by science resource shortages fared better in science than those from unaffected or less severely affected schools, controlling for other variables. However, this result should be interpreted cautiously, as the score disparity was relatively small, and only a few schools in Singapore faced resource shortages.

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Table 6
Quantile Regression Coefficients (Standard Errors), Singapore (n = 4,853)

Variables	q10	q25	q50	q75	q90
Frequency of absence					
Once a week	-123.18***	-135.73***	-130.95***	-111.99***	-89.18***
	(5.66)	(3.89)	(2.98)	(2.64)	(3.04)
Once every 2 weeks	-65.55***	-78.02***	-74.37***	-52.14***	-40.07***
	(4.90)	(3.37)	(2.58)	(2.29)	(2.63)
Once a month	-52.64***	-53.42***	-47.64***	-37.71***	-31.43***
	(3.35)	(2.30)	(1.76)	(1.56)	(1.80)
Once every 2 months	-24.59***	-24.97***	-18.83***	-12.46***	-3.35*
	(2.49)	(1.71)	(1.31)	(1.16)	(1.34)
Never or almost never (ref)					
Students value science					
Strongly value science	57.52***	65.29***	61.31***	53.99***	45.09***
	(2.87)	(1.98)	(1.52)	(1.34)	(1.54)
Somewhat value science	27.80***	32.61***	37.27***	36.22***	28.76***
	(2.81)	(1.93)	(1.48)	(1.31)	(1.51)
Do not value science (ref)					
Home educational resources					
Many	107.55***	88.80***	71.50***	62.82***	50.20***
	(4.48)	(3.08)	(2.36)	(2.10)	(2.41)
Some	73.59***	66.02***	52.13***	40.95***	38.16***
	(3.71)	(2.55)	(1.96)	(1.74)	(1.99)
Few (ref)					
Parents' education					
Don't know	11.08	18.54***	12.11***	17.31***	-2.84
	(6.08)	(4.18)	(3.20)	(2.84)	(3.26)
University or higher	68.80***	56.23***	44.23***	43.62***	23.95***
	(6.30)	(4.33)	(3.32)	(2.95)	(3.38)
Post-secondary	0.66	6.34	5.41	12.44***	-1.49
	(6.36)	(4.37)	(3.35)	(2.97)	(3.41)
Upper-secondary	19.96**	19.47***	9.84**	10.68***	-11.19**
	(6.47)	(4.44)	(3.41)	(3.02)	(3.47)
Lower-secondary	4.07	0.98	2.52	15.01***	-4.00
	(7.40)	(5.09)	(3.90)	(3.46)	(3.98)
Some primary or none (ref)					
Science resource shortage					
Not affected	5.09	-7.99***	-7.83***	-3.42*	3.67*
	(3.36)	(2.31)	(1.77)	(1.57)	(1.81)
Affected	13.79***	-6.40*	-7.31***	-5.23**	-2.18
	(3.78)	(2.60)	(1.99)	(1.77)	(2.03)
Affected a lot (ref)					
Constant	377.52***	450.79***	518.88***	563.25***	617.52***
	(6.52)	(4.48)	(3.44)	(3.05)	(3.50)

Note: ***$p < .001$, **$p < .01$, *$p < .05$

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Discussion

A multitude of factors intricately shape students' academic performance, particularly in the realm of science education. This study explores the impact of absenteeism and students' attitudes toward science on the academic performance of eighth-grade students in Malaysia and Singapore. These factors comprise a fusion of inherent student attributes and their conscientious efforts. Interestingly, despite the contrasting educational achievements of the two nations—with Singapore consistently excelling in mathematics and science since 2000, while Malaysia faces a substantial performance gap—both absenteeism and science attitudes exhibit remarkably similar influences on exam outcomes in both educational settings.

Consistent with findings from past studies (Akkus & Çinkir, 2022; Arulampalam et al., 2012; Keppens, 2023; Klein et al., 2022; London et al., 2016), which support the faucet theory and school disengagement theory, this research distinctly underscores the detrimental impact of absenteeism on students' performance in science across these two countries, which exhibit differing academic standings. This finding highlights the pivotal role of factors affecting academic performance, including regular attendance. Quantile regression analysis shows that absenteeism had a more pronounced impact at higher than lower quantiles in Malaysia. However, in Singapore, its impact was most pronounced at q25 and q50 and least at q90.

One particularly striking distinction emerges when dissecting class attendance patterns: Malaysian students display a threefold higher likelihood of class absenteeism when compared to their Singaporean counterparts. This pronounced divergence in absenteeism rates significantly contributes to the observed performance gap between these two cohorts of students. Employing standardized analysis, if Malaysian students were to align their absenteeism rates with their Singaporean peers, their average science scores would ascend from 460.6 to 483.8. This result compellingly underscores the potential of addressing absenteeism to narrow the performance chasm, ultimately fostering improved academic outcomes in science for Malaysian students. The conspicuous dissimilarity in class absenteeism rates between these two groups implies the existence of distinct underlying factors influencing their attendance behavior. This study underscores the pressing necessity for a comprehensive inquiry into the root causes of this divergence. Given that data on unexcused and sickness-related absenteeism are not available from TIMSS, there is a compelling demand for a separate study to elucidate the reasons behind class skipping. Such an investigation will pave the way for effective, targeted remedial actions to address the issue.

This analysis underscores the pivotal role of students' attitudes toward science in shaping their academic performance in both countries, corroborating the findings of numerous other studies and aligning with Eccles' expectancy-value theory (Al-Mutawah & Fateel, 2018; Ali et al., 2015; Chang & Cheng, 2008; Else-Quest et al., 2013; Juan Andrea et al., 2014; Mao et al., 2021). Notably, among Malaysian and Singaporean students, those who strongly valued science (45% and 42%, respectively) achieved significantly higher scores than those who held only moderate or negligible appreciation for the subject. In Malaysia, the impact of students' attitudes toward science on academic success was more prominent in lower than higher quantiles. However, there was no consistent variation across the score distribution in Singapore. This observation emphasizes acknowledging science's significance and nurturing a positive attitude.

Educators and policymakers can effectively enhance academic outcomes in science education for Malaysian and Singaporean students by cultivating a genuine interest and enthusiasm for science. Fostering students' recognition of the relevance and value of science in their lives can ignite curiosity and passion, ultimately leading to increased engagement and superior learning outcomes. Emphasizing the foundational nature of science can also enable students to perceive its applicability across various facets of their education and future professions, motivating them to excel in their scientific studies.

This analysis corroborates the findings from many studies (Aşkın & Öz, 2020; Evans et al., 2010; Ferguson et al., 2007; Fergusson et al., 2008; Khan et al., 2019; Li et al., 2020; Li & Qiu, 2018; Liu et al., 2020; Özkan & Tekeli, 2021; Sirin, 2005) to emphasize the critical importance of ensuring ample educational resources at home to support students' learning and academic success, particularly in the field of science. Ensuring access to educational materials and resources can bridge the achievement gap between students with varying levels of home-based resources, both in Malaysia and Singapore. Notably, the availability of internet access also significantly influences students' academic performance (Fernández-Gutiérrez et al., 2020; Özkan & Tekeli, 2021; Román Carrasco

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& Murillo Torrecilla, 2012; Skryabin et al., 2015; Tan & Hew, 2019), suggesting that disparities in home educational resources—such as the number of books and internet access—likely contribute to the observed performance gap in science between Malaysian and Singaporean students.

Parents' educational level and active involvement in their children's education emerge as potent factors shaping students' academic achievement, a finding corroborated by prior research (Abu Bakar et al., 2017; Davis-Kean, 2005; Murnane et al., 1981). Singaporean students, three times more likely to have parents with a university education than their Malaysian counterparts, likely account for part of the differences in their exam results. Malaysia's steady progress in educational attainment, with a tertiary enrolment ratio reaching 40% in 2022, suggests a promising trajectory toward closing the academic performance gap between Malaysian and Singaporean students. In both countries, parents' educational attainment matters more in students' academic success in the lower quantiles than in higher quantiles, as was the case with the availability of home resources.

The superior academic performance of Singaporean students compared to their Malaysian counterparts can be attributed, in part, to differing levels of socio-economic development. Singapore boasts a high human development index of .939 (ranked 12th globally) and a per capita income of USD 82,808, whereas Malaysia's metrics stand at .803 (ranked 62th globally) and USD 12,471 (United Nations Development Programme, 2022; World Bank, 2023). Malaysia's fluctuating policy on teaching mathematics and science in English and the national language has presented challenges to learning these subjects, given that most reference materials are in English. Investigating Malaysia's underperformance in PISA compared to Korea and Singapore, Perera and Asadullah (2019) found that more than half of the achievement gap between the high performers and Malaysia still needs to be explained, even after accounting for socio-economic and school-specific factors. This finding suggests potential explanations related to policy, institutions, and culture.

This analysis carries inherent limitations due to secondary data lacking some essential information for further examination, such as the reasons for absenteeism and the lack of interest in science subjects. External factors are equally crucial, including teachers' professional development (Tang et al., 2022), teachers' preparation and quality of teaching (Lay & Chandrasegaran, 2018; Shannag et al., 2013), quality and equal science education system (Jiang et al., 2023), the learning environment at school and home (Lay & Ng, 2021), and the availability of resources. Even broader educational frameworks within a country, including language choices for instruction, can significantly impact students' learning journeys.

One of the key strengths of this study lies in its potential policy implications. The significant findings related to absenteeism, limited home educational resources, and parental education underscore the specific areas where educational policymakers in Malaysia can take proactive steps to improve student performance. This study goes beyond merely identifying issues; it offers actionable insights that can guide educational planners in addressing these shortcomings and enhancing science education outcomes in the country.

The use of weighted least squares and quantile regression analysis allows this study to examine the net effects of various factors on the academic performance of eighth-grade students. By considering other factors such as home educational resources and parents' education, this study also examines the roles of other factors affecting the educational faucet's output. This perspective underscores the importance of effectively tackling root causes to improve science achievement.

This study contributes to the field of science education research, as it allows one to draw insightful comparisons between two countries with contrasting performances in TIMSS rankings. By exploring the impact of absenteeism and students' attitudes toward science in these two contexts, this study offers a valuable contribution to understanding science education on a global scale to address educational disparities and improve science education in diverse international contexts. The insights gained from this research can inform educational policies and practices in other countries facing similar challenges. Research findings on the factors affecting students' academic performance should be disseminated widely to all stakeholders to take appropriate measures to ensure that all students acquire the knowledge and skills needed to promote sustainable development, as promulgated in the Sustainable Development Goals.


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Conclusions and Implications

This analysis has the potential to contribute significantly to advancing educational theories and formulating evidence-based policies aimed at improving educational outcomes and reducing disparities, with a specific focus on addressing absenteeism and fostering a positive attitude toward science among students. By examining two countries with divergent performance levels in science education, this study offers unique insights that can inform educational theories and policy initiatives in several ways.

Firstly, the findings related to absenteeism underscore the critical role of regular attendance in student performance, regardless of the country's academic standing. The quantile regression analysis highlights how absenteeism impacts students differently across the performance spectrum. This nuanced understanding can inform the development of targeted interventions for students at various performance levels. Moreover, the stark contrast in class absenteeism rates between Malaysia and Singapore points to country-specific factors influencing attendance behavior. Investigating these factors and implementing context-specific strategies can be instrumental in reducing absenteeism and improving overall academic performance.

Secondly, analyzing students' attitudes toward science offers valuable insights into the significance of nurturing a positive perception of the subject. The consistent positive correlation between valuing science and higher academic performance holds implications for curriculum design and pedagogical approaches. Educators can consider incorporating methods that emphasize the relevance and applicability of science in students' lives, sparking their interest and enthusiasm. This approach aligns with the idea of "science capital," which suggests that students' attitudes toward science are influenced by their exposure and experiences. Policy initiatives can be designed to enhance students' science capital, thus promoting better learning outcomes.

Regarding evidence-based policies, the study's findings suggest that addressing absenteeism and promoting positive attitudes toward science should be integral components of education reform efforts. The intervention strategies to reduce absenteeism can include counseling and mentoring programs, buddy systems (peer mentor programs), and parental involvement initiatives. Moreover, the education system should focus on curriculum enhancements emphasizing science's practical relevance and real-world applications through internship programs and stimulate students' interest in science subjects.

Furthermore, this analysis highlights the importance of providing adequate home-based educational resources to enhance learning outcomes. Policymakers can explore ways to provide equitable access to resources, such as digital learning materials and internet connectivity, especially for students from disadvantaged backgrounds. Besides, there must be efforts to support parents in actively engaging with their children's education.

This study sheds light on the influence of absenteeism and students' attitudes toward science on academic performance. It offers actionable insights that can enrich educational theories and guide the formulation of evidence-based policies. By addressing absenteeism, nurturing a positive attitude toward science, and promoting equitable access to resources and parental involvement, educational systems can work toward enhancing outcomes and reducing disparities, ultimately fostering a brighter future for students in diverse learning environments.

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Declaration of Interest

The authors declare no competing interest.

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