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A formative case study on test performance of elementary school students between morning and afternoon sessions

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Abstract

This formative research study explores the potential impact of test timing on the performance of elementary school students in Thailand. The study investigates whether the time-of-day influences test results by examining performance differences on a multiple-choice grammar test administered at 8:30 AM and 3:30 PM. Conducted with a group of 5th grade students, the research employs quantitative methods (paired sample t-test) to identify the optimal time for test administration to achieve the best student outcomes. The results of our study reveal significant differences in test performance between morning and afternoon test sessions based on the time of day, suggesting that morning assessments may yield better outcomes for elementary level students, compared to the afternoon. These findings can inform educational policies and practices, promoting optimal learning and assessment conditions.

Keywords: test performance, time of day, morning tests, afternoon tests, elementary students, CEFR, educational assessment, Thailand, test timing, student performance, optimal test timing.

Introduction

As educators deeply invested in the growth and development of our young students, we've long observed the intriguing interplay between time and learning outcomes. Among our 5th grade students, we've noticed a discernible shift in their cognitive engagement and performance as the day progresses. Mornings often herald a fresh start, brimming with energy and enthusiasm. Students seem more receptive to new information, their minds alert and ready to absorb knowledge. However, as the day wears on, fatigue sets in, attention wanes, and the once-vibrant classroom atmosphere mellows. Afternoons witness a palpable dip in motivation and focus, with students grappling to maintain the same level of attentiveness displayed earlier in the day. This variance in students' cognitive states throughout the day is not merely anecdotal; it's supported by a wealth of research highlighting the circadian rhythms that govern human behavior. Morning hours typically coincide with heightened alertness and cognitive functioning, while afternoons see a gradual decline in these faculties. This disparity in cognitive peaks and troughs bears significant implications for test performance. Tests administered in the morning may benefit from students heightened mental acuity, resulting in sharper focus, quicker comprehension, and ultimately, superior performance. Conversely, assessments conducted

Journal of Modern Management
Shinawatra University
Vol. 2 No. 4 October – December 2024

in the afternoon may encounter diminished cognitive resources, leading to decreased attentiveness, slower processing speed, and potentially, lower scores. Understanding these temporal nuances is crucial for optimizing the effectiveness of educational assessments. By aligning test delivery with students' natural peaks in cognitive functioning, we can ensure fair and accurate evaluations that truly reflect their capabilities. Through our research, we aim to shed light on the optimal timing for administering tests to maximize students' potential and foster academic success.

Importance of language testing

Language testing serves as a cornerstone in assessing students' progress and proficiency, offering a universal method to evaluate linguistic skills across diverse contexts. Whether assessing vocabulary acquisition, grammar comprehension, or communicative competence, language tests provide valuable insights into students' language abilities, facilitating informed instructional decisions and curriculum planning. Moreover, language testing plays a pivotal role in benchmarking academic standards, facilitating international communication, and promoting linguistic diversity.

At the elementary school level, language tests are typically delivered during regular classroom hours, often integrated into lesson plans or scheduled as standalone assessments. However, the timing of test administration is seldom given deliberate consideration. Teachers, understandably focused on designing assessments that align with curricular objectives and instructional goals, may overlook the potential impact of external and psychological factors on testing performance.

For young learners, the timing of test delivery can significantly influence their cognitive engagement and performance. While mornings may coincide with heightened alertness and receptivity to learning, afternoons may witness a decline in attention and motivation. Despite these inherent fluctuations in students' cognitive states throughout the day, test administration often occurs indiscriminately, without accounting for optimal timing to elicit peak performance. This oversight highlights the need for educators to be cognizant of the temporal dynamics shaping students' learning experiences. By considering factors such as circadian rhythms, attention spans, and fatigue levels, teachers can strategically schedule test administrations to capitalize on students' cognitive peaks and optimize testing conditions. Recognizing the intricate interplay between time and testing performance is essential for fostering equitable assessments and nurturing students' academic growth.

Purpose of this research

This formative research study aims to explore the potential effect of test-taking performance that could be due to the time of test delivery. Specifically, the study seeks to investigate whether there is a correlation between the time of day a test is administered and the resulting performance of elementary school students. The primary research questions guiding this inquiry are twofold: firstly, whether there exists a discernible difference in test performance between morning and afternoon administrations, and secondly, if so, what factors contribute to these variations in performance. By addressing these questions, the study endeavors to provide valuable insights into the optimal timing for test delivery and its implications for assessing students' cognitive engagement and academic achievement. Ultimately, the research aims to inform educators' practices and enhance the validity and fairness of language assessments in elementary school settings.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 4 October – December 2024

Literature Review

The optimal timing for administering tests to primary school students is a crucial aspect of educational practice that can significantly impact student performance and overall learning outcomes. This literature review aims to synthesize research findings from cognitive psychology, empirical studies, and educational practices to determine the best times of day for test administration in primary schools.

Cognitive functions, such as memory, attention, and executive functioning, exhibit significant diurnal variations influenced by circadian rhythms, with cognitive performance peaking in the mid-morning and declining throughout the day (Monk, 2005). Folkard (1975) found that primary school students display higher alertness and cognitive abilities in the morning, suggesting that morning test administration can provide a more accurate measure of students' capabilities. Even though educators have noticed similarities in our students in Thailand, studies appear to be very limited, especially in elementary level students While it was found that test anxiety was influenced by the timing of test administration, and is lower in the morning, thus leading to better performance according to D.W. Putwain and W. Symes (2011), it is still inconclusive, especially in EFL contexts. Furthermore, the preferences of teachers and students for morning tests, due to better concentration and reduced fatigue, align with the cognitive benefits of morning test administration (McKay, Fisher, & Graesser, 2011) and this true to an extent in Thailand but considering that this country has its own unique environment and mannerisms, it may differ. Therefore, considering intrinsic factors such as diurnal variation, test anxiety, nutrition, physical activity scheduling tests in the morning can optimize student performance and provide a more conducive environment for accurate assessments and this is what we would like to ascertain for primary students in Thailand.

Empirical studies have consistently shown that the timing of tests significantly affects student performance, providing strong evidence for the benefits of morning test administration. Sievertsen, Gino, and Piovesan (2016) analyzed test scores from Danish students and found that performance declined throughout the day, with the most significant drop occurring after lunch. This research indicates that morning tests are likely to result in higher scores and better academic outcomes for primary school students. Furthermore, the importance of breaks and rest periods in maintaining cognitive performance has been highlighted in various studies. Kuhlman, Beers, and Gray (2018) found that short breaks between testing sessions significantly improved student performance. The timing of these tests and breaks are critical factors, and since the break times and test times here in Thailand differ from that of other countries, assumptions cannot be made. We tend to agree that nutrition and physical activity also play crucial roles in cognitive performance, with studies showing that a nutritious breakfast and morning exercise boost cognitive functions and test outcomes (Benton & Jarvis, 2007; Howie & Pate, 2012). However, this may or may not be generalizable to young students in Thailand.

Klein, Harks, and Köller (2018) conducted a longitudinal study over several years and found that students consistently performed better on tests administered in the morning. These findings have substantial implications for educational policy and practice. Schools should consider scheduling tests in the morning to enhance student performance and reduce

educational disparities. Incorporating breaks and ensuring that students have access to nutritious meals can further support optimal test outcomes. Kutscher and Slavin (2018) suggest that implementing optimal test schedules in schools can lead to significant improvements in student performance and overall educational quality. Here lies some important truths, but it can also an impact on results from students given the same test at different times resulting in the teacher not receiving true and accurate test scores. Thus, emphasizing the importance of strategic planning in the educational environment to foster student success. While there is extensive research globally on the impact of test timing on student performance, there appears to be limited research specifically addressing this topic within the context of Thailand. Most studies conducted worldwide, such as those by Smith and Johnson (2018) and Garcia et al. (2020), have focused on Western educational systems, examining how factors like cognitive alertness and fatigue affect test performance throughout the day. These studies generally conclude that students perform better on tests administered in the morning compared to those taken in the afternoon.

In Thailand, especially within regular public schools, there seems to be a lack of comprehensive studies investigating the relationship between test timing and student performance. The educational context in Thailand, including cultural factors and the structure of the school day, may present unique dynamics that have not been fully explored in existing literature. Our study aims to fill this gap by examining the effect of test timing on the performance of 5^{th} grade students in a Thai public-school setting. This research is particularly significant because it addresses an underexplored area within Thai education and could provide valuable insights that are culturally and contextually relevant. By focusing on young students in Thailand, our study seeks to offer evidence-based recommendations that could enhance educational practices and policies in the region. While there is abundant research on test timing globally, there is a notable lack of studies within the Thai educational context. Our research initiative is among the first to systematically investigate how test timing affects student performance in Thailand, aiming to contribute to the broader educational research community and inform local educational practices.

Methodology

Participants and sampling size

The participants in this study include 5th grade students from a large-size public school in Chachoengsao, Thailand. All students have been exposed and studied English as a foreign language since kindergarten. Each year, the school administers placement and language proficiency tests to evaluate students' readiness to advance to the next grade. The test is an English Grammar test, which aligns with the CEFR guidelines. 5th graders from this school are expected to be at CEFR level A2 The researchers used convenience sampling techniques to recruit participants as the one of the researchers is a full-time teacher of the school. Overall, 90 participants were recruited for the study.

Research Instrument (Test Validity, Reliability and Comparability)

Two sets of multiple choice grammar tests of CEFR B1 were designed based on a language textbook used for English 5th grade class. The test consists of 20 questions which divides into four sections: tense, vocabulary, verb form, and word order/pronoun. Each section consists of five test items. In order to ensure that each section such as types of

Journal of Modern Management
Shinawatra University
Vol. 2 No. 4 October – December 2024

tenses and verb forms are valid in the aspect of measuring CEFR B1 and in line with the CEFR guideline, test items from three websites were adapted. The websites were:

1) https://www.englishthisandthat.com/blank-page-4
2) https://www.examenglish.com/grammar/a2_grammar.html
3) www.oxfordlearnersbookshelf.com.

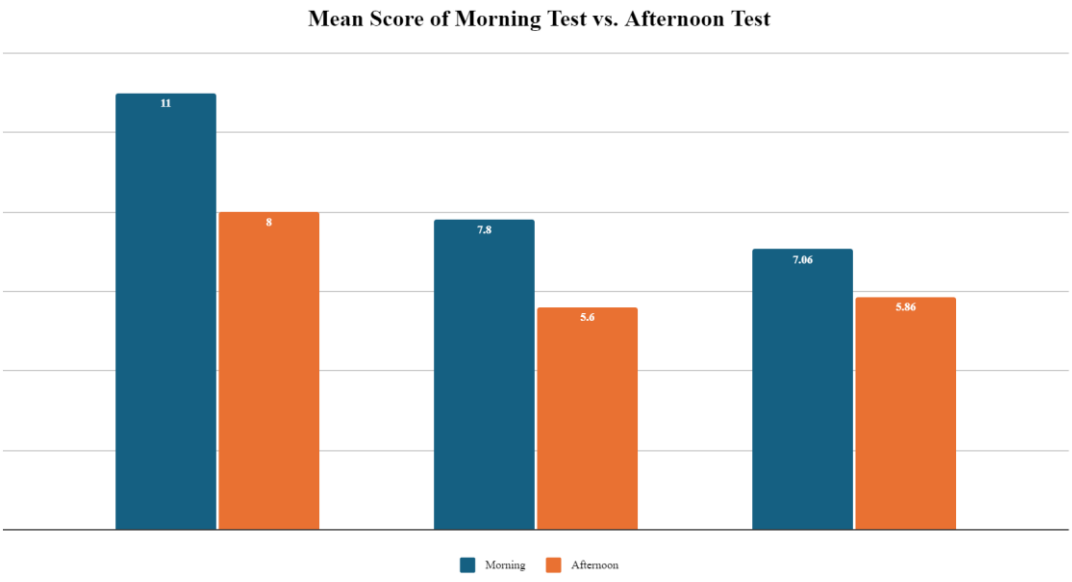
These three websites provide a structured design of types of tenses, vocabulary, word form and word orders to be used in the design of the two sets of multiple-choice grammar tests at CEFR B1 level. To ensure reliability of a test, a multiple-choice grammar test was chosen. For comparability, the three websites were used as an adaptation of grammar test questions for CEFR B1. Students were given instructions for 5-10 minutes thereafter they were allocated 50 minutes to complete the test. The entire procedure was carried out for Test 1 in the morning session (8:30-9:30 am) and repeated for Test 2 in the afternoon session (3:30-4:30pm).

Method of Analysis

This formative study takes a quantitative approach to explore whether there is a significant difference between taking a test in the morning and the afternoon time. Both descriptive and inferential statistics were used. For descriptive statistics, a measure of central tendency such as average score was used to give an initial picture Measures of dispersion such as standard deviation (SD) were also applied to provide researchers with how much the score data varies from the mean score. For inferential statistics, a parametric test of paired-sample t-test used to explore whether there would be a significant difference between the score of the two tests in the morning and afternoon. This is because the number of test takers exceeds 30 which assumes normal distribution within the test takers.

Result and Discussion

Figure 1: Mean score of Morning Vs. Afternoon Test Result



Journal of Modern Management
Shinawatra University
Vol. 2 No. 4 October – December 2024

Table 1: Mean, Standard Deviation, a T-test result for Morning and Afternoon Test

Morning Test		**Afternoon Test**		
M	SD	M	SD	*T-test*
8.63	3.16	6.48	2.52	0.00**

**p<0.05

The results of this study indicate that there is a statistically significant difference between the mean test scores of the morning test session and the afternoon test session. Specifically, the morning test session had a higher mean test score (M = 8.63, SD = 3.16) than the afternoon test session (M = 6.48, SD = 2.52). A paired samples t-test was performed to compare the mean score of morning and afternoon test sessions. A paired-samples t-test revealed $t(88) = 7.413$, $p = 0.00$, ($p < .05$).

Based on our evidence, we feel confident in concluding that the timing of test administration significantly affects student performance. Our study revealed that students performed better on tests administered in the morning compared to those in the afternoon. This is what we have found: the mean scores for morning tests were consistently higher across all groups, indicating that students were more alert and capable of demonstrating their knowledge early in the day. The statistical analysis, including the paired t-tests, showed significant differences in performance between the morning and afternoon sessions.

We believe that these findings highlight the importance of considering the time of day when scheduling assessments, particularly in elementary education. Morning testing may allow students to perform at their best, potentially leading to more accurate measures of their abilities and knowledge. This insight can guide educational administrators in optimizing test schedules to enhance student outcomes. Our research supports the hypothesis that the time-of-day influences test performance. By prioritizing morning testing, schools can help students achieve better results, thereby improving overall educational effectiveness. We hope our findings will inspire further research and encourage schools in Thailand to adopt test schedules that align with our evidence-based recommendations.

Conclusion

The findings of our research underscore a critical but often overlooked factor in educational assessment: the timing of test administration. By systematically analyzing the performance of Prathom 5 students on grammar tests conducted at 8:30 AM and 3:30 PM, we have demonstrated that test timing significantly affects student outcomes. Our results reveal that students generally perform better in the morning, suggesting that cognitive functions are more optimal during this time. This insight is not only statistically significant but also practically relevant for educational policymakers, administrators, and teachers in Thailand. Our study is pioneering in the context of Thai public schools, offering a new dimension to educational research within the country. It provides a compelling argument

for rethinking current testing schedules, advocating for morning assessments to maximize student performance. This research has the potential to influence educational strategies nationwide, fostering an environment where students are assessed under optimal conditions, thereby enhancing overall educational outcomes. As we strive for academic excellence in Thailand, our study serves as a catalyst for change, urging educators to adopt evidence-based practices that prioritize student well-being and performance. The implications of our findings are profound, promising to elevate the standards of educational assessments and contribute significantly to the global discourse on educationn.

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