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Block Course Learning Approach in Thailand: Prospective Mathematics Teachers' Perceptions

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ABSTRACT

This research is driven by the limited literature regarding the effectiveness of the block course learning model in mathematics teacher education, particularly in Thailand's international school context. While this model is known for its intensity, understanding of how prospective teachers perceive its practical implementation remains scarce. This study aims to describe the perceptions and experiences of the researcher as a prospective mathematics teacher regarding block course implementation at Yanyawit School, Thailand, with student learning outcomes as supporting evidence. A qualitative-dominant mixed-methods approach with a Sequential Exploratory design was employed. The qualitative phase explored pedagogical phenomena to provide a framework for the subsequent descriptive quantitative phase. The unit of analysis focused on the researcher's own experiences as a student teacher, supported by interviews with the deputy principal, mathematics teachers, and 29 MathayomTon 1 students selected via purposive sampling. Data were collected through participant observations during the internship period, semi-structured interviews, and mathematics final examination (UAS) documents validated by expert review. Qualitative thematic analysis revealed four emergent themes: 1) Institutional strategic rationale for curriculum integration, 2) Pedagogical strategies using mathematical play media, 3) Implementation barriers related to student fatigue during long sessions (60-120 minutes), and 4) Positive perceptions of academic impact. Descriptive statistical analysis of exam scores supported these findings, showing that the majority of students achieved moderate outcomes (60-79). Future research is recommended to conduct correlation tests between block course time intensity and conceptual retention, while developing diverse active teaching methods to mitigate learning fatigue during extended instructional durations.

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Introduction

Education is a systematically designed process aimed at developing students' potential to become individuals of noble character, skilled, and intelligent (Fajar, 2019). Ramadhan (2023) also states that education is a process to change the attitudes and behaviors of individuals and groups in order to mature themselves through training and learning activities, which involve the roles of educators (teachers) and students (pupils) in it. Learning at every level of education is carried out through various approaches. Various approaches have been widely applied, such as scientific, contextual, realistic, inquiry, constructivism, humanistic, and *block courses* (Aulia et al., 2023; Umi et al., 2024; Safitri et al., 2024).

According to Fadhilah et al. (2022), *the block course* learning approach is one that organizes learning hours concisely in a single unit of time with a focus on one subject. Learning schedules through the block system are condensed into fewer but longer meetings, thus providing greater flexibility and focus in learning activities (Widarto et al., 2024). Furthermore, according to Oktaviani & Novrita (2025), through the structured division of learning time into blocks, teachers and students can focus more on exploring the material, applying concepts contextually, and improving the effectiveness and quality of the learning process, while achieving optimal learning outcomes.

Block learning is an instructional approach that allows students to focus their attention on one topic or subject for a certain period before moving on to the next material (Safitri et al., 2024). In addition, according to the LAB Board of Governors (Harahap & Mujib, 2021) in this system, there are fewer meetings for each subject, but they are longer in duration, so that learning activities can be carried out intensively and more flexibly. The average duration of each meeting is between 60 and 120 minutes, which allows students to study the material in more depth in one session (Pertiwi et al., 2023). These conditions are the basis for the emergence of various advantages in the *block course* approach.

The *block course* approach has several advantages in learning. One of them is that through longer meeting durations, students can study one topic in depth, so that their understanding of the concept becomes more optimal (Jatmoko et al., 2024). The block-based learning approach allows teachers to integrate active methods, such as discussion, practice, and reflection, into a single session (Pertiwi et al., 2023). Another advantage is that fewer meetings help reduce rapid material changes, allowing students to focus and concentrate longer on a single subject (Oktaviani & Novrita, 2025).

On the other hand, the *block course* approach also has limitations. Long meeting durations can cause fatigue or decreased student concentration if not managed properly (Nurhaliza et al., 2025). In addition, lesson planning becomes more complex for teachers because they must adjust the material so that it can be completed in one long session (Pertiwi et al., 2023). Furthermore, according to Arsil Majid (2021 in Syauqi, 2018), the *block course* approach has the potential to make students' memory of the material less permanent because the subject is only taught in a short period of time. Thus, the effectiveness *of block courses* is highly dependent on time management strategies and the learning methods applied to improve student learning outcomes.

In line with this, learning outcomes are an important indicator for assessing the effectiveness of *block courses* in the learning process. Learning outcomes are a measure of student achievement after participating in the learning process, in terms of knowledge, skills, and attitudes (Zainudin & Ubabuddin, 2023). In general, learning outcomes cover the cognitive, affective, and psychomotor domains, which complement each other to foster positive attitudes

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and develop practical skills in students (Nurhasnah et al., 2023). In addition, learning outcomes are also influenced by various internal and external factors (Safitri et al., 2022; Zulkfli, 2019).

Factors that influence learning outcomes include internal factors such as interest, readiness, and psychological conditions, as well as external factors such as teaching methods, family support, learning resources, and a conducive school environment with a culture of discipline and cooperation (Ipa, 2022; Siregar, 2024; Yandi et al., 2023). In mathematics learning, learning outcomes reflect students' ability to understand concepts, principles, and procedures systematically while developing logical, analytical, critical, and creative thinking skills to solve everyday problems (Meidianti et al., 2022; Zebua et al., 2024).The cognitive domain is the main benchmark because it shows mastery and application of concepts, so that mathematics learning outcomes not only describe academic competence but also practical skills that can be measured through indicators of success (Bloom, 1956 Nurdian et al., 2021; Virgantoro & Rofiqi, 2025; Zainudin & Ubabuddin, 2023).

Mathematics learning outcome indicators according to Bloom's Taxonomy by Anderson & Krathwohl (Nafiati, 2021) include six levels of cognitive domain, namely: (1) Remembering, (2) Understanding, (3) Applying, (4) Analyzing, (5) Evaluating, and (6) Creating. These levels help teachers evaluate the extent to which students understand, apply, and analyze mathematical material and develop higher-order thinking skills (Ratno et al., 2024). The existence of learning outcome indicators enables teachers to systematically assess students' academic competencies and practical skills (Marta et al., 2025). Thus, these indicators form the basis for assessing the overall quality of student learning outcomes.

Optimal learning outcomes emphasize not only academic achievement but also character development, life skills, and lifelong learning abilities so that graduates are ready to face real-life challenges (Virgantoro & Rofiqi, 2025). The benefits of learning outcomes can be felt by various parties, including teachers who obtain information about the effectiveness of learning strategies (Hayaturraiyan & Harahap, 2022), students who are motivated to improve their performance (Fernando et al., 2024), and educational institutions that can assess their success in meeting the required competencies (Wahidin, 2024). Therefore, the discussion of learning outcomes should not only focus on theoretical concepts but also be closely related to innovative learning approaches that can improve student achievement. This aligns with the findings of Rusmitaningsih (2020), which demonstrate that implementing a mastery learning-based block system significantly enhances student learning outcomes. Furthermore, studies by Khairunnisa et al. (2023) and Nabilah et al. (2021) support this trend, showing that the integration of contextual, culturally relevant approaches and engaging learning methods effectively boosts both student motivation and academic achievement across various subjects.

While the block course approach is gaining interest in Indonesia, its systematic implementation in mathematics education remains nascent. In contrast, certain educational institutions in Thailand, such as Yanyawit School, have long integrated this approach within their curriculum. Conducting this study in Thailand provides a unique opportunity to observe a matured block system, offering international perspectives that can serve as a benchmark for developing similar innovative scheduling models in Indonesia and the broader Southeast Asian context. Therefore, this study, titled *'Perceptions and Experiences of Prospective Mathematics Teachers on the Block Course Learning Approach: A Case Study in Thailand,'* seeks to bridge this gap by providing a reflexive account of the implementation process and its subsequent impact on student responses and academic achievement.

Method

Design Research

This study employs a qualitative-dominant mixed-methods approach with a Sequential Exploratory Design (Sugiyono, 2021). The qualitative phase serves as the primary foundation to explore the pedagogical phenomena of the block course, which subsequently informs the interpretation of the quantitative descriptive phase. Specifically, emergent themes from the qualitative data, such as "Strategic Rationale" and "Implementation Challenges", provide the framework for analyzing the descriptive student learning outcomes. Given that the quantitative phase is used to describe results rather than test a formal hypothesis, this study is characterized as a qualitative case study supported by descriptive statistics.

Population and Samples

The subjects of this study are 29 MathayomTon 1 students at Yanyawit School, Thailand, selected using a purposive sampling technique (Arieska & Herdiani, 2018). To ensure data richness, key informants were also involved, including the school's deputy principal, mathematics teachers, and three students who were actively engaged in the learning process.

Instruments

The research utilized three primary instruments. First, an interview protocol was employed to explore three main domains, namely strategic rationale, pedagogical execution, and perceived impact. One example of the interview question is: "How does the long duration (60–120 minutes) affect your strategy in delivering complex mathematical concepts compared to traditional schedules?" with the full list of questions provided in Table 1. Second, an observation guide was used, which was specifically aligned with the implementation of the block course system and focused on indicators of student engagement as well as the effectiveness of mathematical play media during extended learning sessions. Third, the study used the school's official Mathematics Final Examination (UAS), which consisted of 20 items, including 15 multiple-choice questions and 5 essay questions. The test blueprint was developed based on Bloom's Taxonomy, with a proportion of 20% for C2 (Understanding), 40% for C3 (Applying), and 40% for C4 (Analyzing).

Table 1. Question and Answer

No	Question	Answer
1	What is the primary reason the Vice Principal of Yanyawit School implemented the block course approach?	To allow students to focus on one subject for a certain period, preventing the difficulty of mastering material when switching between many subjects daily.
2	Is the block course system a national policy in Thailand?	No, it is not a national policy; it is an approach developed internally by the school to suit its specific character.
3	How do block courses serve as a "bridge" for the curricula used at Yanyawit School?	It balances and integrates the Thai national curriculum with the Islamic curriculum, ensuring both run smoothly.
4	What preparations did the school undertake for teachers during the implementation phase?	Internal socialization, workshops on teaching long classes, method variation, and training in utilizing digital media.
5	What are the two forms of routine evaluation implemented by the school?	Daily brief evaluations (reflections/engagement notes) and formal weekly block evaluations (tests and achievement reports).

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No	Question	Answer
6	How do mathematics teachers structure their material?	Material is structured sequentially, moving from basic concepts to practical application.
7	What creative media do teachers use to prevent boredom?	Mathematical play media such as operation cards, counting game boards, and interactive quizzes.
8	According to teachers, what is a clear benefit for students?	Students become better able to explain the material in their own words.
9	What are the two main challenges acknowledged by the school?	Student boredom during long sessions (especially in the afternoon) and significant learning gaps if a student is absent.
10	What solutions are implemented for students who fall behind?	Group discussions, small projects, additional consultations, and encouraging peer-to-peer help.
11	How does the block system affect student focus and achievement?	It allows students to focus more on formulas without distractions, leading to better math grades.
12	What specific factors increase student enthusiasm?	The use of games and group discussions, which break up the heavy theoretical parts of the lesson.

The research encompassed two primary tasks. The initial assignment was the Mathematics Final Examination, aimed at assessing students' cognitive ability in comprehending the mathematical subjects covered over the five-week instructional period. The second task involved semi-structured interviews and observations aimed at examining perceptions of the rigorous learning time of 60 to 120 minutes, the material's focus, and problems such as boredom that may occur within the block system.

Procedures

This investigation encompassed both quantitative and qualitative methodologies. The quantitative component verified subject validity through an expert evaluation by the Deputy Principal and the Mathematics Teacher at Yanyawit School to verify curriculum alignment. Reliability was upheld by inter-rater consistency between the researcher and the supervising educator. In the qualitative component, trustworthiness was established by member verification and peer debriefing with the senior mathematics instructor to review field findings. An audit trail was established to ensure analytical consistency throughout the investigation.

The data collecting adhered to a systematic chronological sequence. The initial stage was the observation phase, during which five participant observation sessions were carried out to document classroom dynamics and the real-time execution of the block system. The subsequent phase involved conducting semi-structured interviews with informants, each lasting roughly 30 to 45 minutes. The last phase entailed gathering students' official final examination results as quantifiable evidence of educational outcomes.

Analysis

Qualitative data were examined by thematic analysis utilizing open coding, axial coding, and selective coding. The coding method indicated that initial codes like Focus-Subj and Bridge-Curr were categorized under strategic rationale, culminating in the emergent topic of institutional motive for the block course. Codes like Math-Play and Seq-Mat were classified under pedagogical approach, embodying the topic of innovation in instructional methods and media. Simultaneously, codes like Long-Fatig and Abs-Gap were categorized as implementation obstacles, signifying difficulties in block system execution. Ultimately, codes such as Deep-Und and Better-Grades were categorized under student reaction, reflecting opinions of academic influence.

Research Findings

Research Findings 1. Qualitative Analysis Result

Yanyawit School in Yala, Thailand, has implemented a block course learning model since the 2568 academic year (2025 AD). This system allows students to study one subject intensively for five weeks with a structured schedule. Each day focuses on only one subject so that students can learn concepts in greater depth without distraction. The school's activity pattern continues to combine academic aspects with religious practices such as prayer, Dhuha prayer, and recitation of the Qur'an. Thus, block courses serve not only as a pedagogical strategy, but also as a means of Islamic character building.

The main purpose of implementing block courses is to increase students' focus and understanding of the material being studied. For example, when the schedule shows mathematics, the entire daily session is focused on that subject, while certain days are set aside specifically for religious education and sports. Field observations show that activities take place regularly from morning to afternoon with long learning sessions that provide space for in-depth exploration of the material. This activity structure encourages consistency in learning and supports the achievement of basic student competencies. The block course-based learning schedule is shown in Figure 1.

Figure 1. Block course-based learning schedule

The schedule at this school is balanced between religion, academics, and sports. Mondays and Thursdays are dedicated to the study of eight Islamic subjects. These subjects include fiqh, the Qur'an with tahfiz and tajwid, Al-Hadith, Arabic, aqidah or tauhid, akhlak, Islamic cultural history (SKI), and Malay or Jawi Islami, which is a local characteristic of the Yala region. Meanwhile, other days are used for block courses in general subjects such as mathematics, science, Thai language, and English. As for activities on Fridays after Zuhur, they are focused on sports. The types of sports chosen include volleyball, soccer, badminton, and archery. Archery is seen not only as a physical activity, but also as an Islamic skill that strengthens the integration between academics, spirituality, and physicality at this school.

Reasons for Schools Implementing Block Courses

An interview with one of the school officials, Vice Principal Yanyawit, revealed the main reason for implementing the block course approach in learning, especially in mathematics. The source explained,

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> *We want students to focus on one subject for a certain period of time. If they have to switch between many subjects every day, it is difficult for them to master the material. With the block system, conceptual understanding is more coherent, and mathematical thinking skills can develop better.*

From this statement, it can be understood that the implementation of block courses is not merely a schedule management strategy, but rather stems from the school's internal need to strengthen the quality of the learning process. Regarding the basis for this policy, the source emphasized,

> *Block courses are not a national policy in Thailand. It is an approach that we have developed to suit the character of the school. We do indeed implement two curricula, namely the Thai national curriculum and the Islamic curriculum, and we use block courses as a bridge so that both can run in a balanced manner.*

Thus, this approach is both a school innovation and a strategy for integrating academics and Islamic values.

Block Course Implementation Stages

During the implementation phase, the school prepared teachers through internal socialization and training. These activities aimed to better prepare teachers to deal with the dynamics of long-duration classes and to create effective learning experiences. The school said:

> *We held a small workshop on teaching in long classes, how to vary methods, and maintain the rhythm of the class. We also trained teachers to utilize digital media so that students do not get bored easily*.

In addition, the school implements two forms of routine evaluation. These evaluations assess not only conceptual understanding, but also student engagement and attitude development. Based on the explanation of the workshop and ideas about evaluation methods, the school has decided that:

> *Every day after class, there is a brief evaluation in the form of reflections or teacher notes on student engagement. Then, at the end of the week, there is a more formal block evaluation, such as tests, achievement reports, and character development notes*.

The mathematics teachers interviewed provided more technical explanations about learning. They explained that the material was structured sequentially from basic concepts to application so that students could follow more easily. One of the mathematics teachers said that:

> *In one block, I organize the material from basic concepts to application. There is enough time, but I have to be creative so that students don't get bored. Therefore, I use mathematical play media, such as operation cards, counting game boards, or interactive quizzes. This way, students remain active and understand the concepts more quickly.*

He also emphasized that this system requires more careful planning, but the benefits are clear: *"Students become better able to explain the material in their own words."* However, challenges remain. The school acknowledges that. Long sessions sometimes make students bored, especially in the afternoon. If someone is absent for just one day, they miss a lot of material. Teachers must be extra creative to keep the class active.

Variations in Block Course Methods and Strategies

The solutions implemented include a variety of methods, group discussions, small projects, and additional consultations for students who are falling behind. *"We also encourage peers to help each other so that no one is left behind,"* he added.

The quality of learning is another concern; therefore, this learning requires innovation in terms of the variety of methods and learning strategies. Based on innovations in the implementation of block courses, researchers interviewed several subjects. The first student commented:

> *I think it's good because it allows me to focus more. I don't have to switch to other subjects, so I can really understand the formulas. My math grades are better now.*

This view shows the positive effect of the block system on academic achievement. This positive effect can be seen in the way students adaptively understand mathematical concepts and other subjects. Other students said,

> *If it's too long, I get tired quickly. Sometimes math feels difficult when it's just theory. But when there are games or group discussions, I feel more enthusiastic. However, if I miss a day, I fall behind a lot.*

This statement emphasizes the importance of varying teaching methods. This variation in teaching methods is evident in the way students describe the learning process as interesting and enjoyable. Meanwhile, the third student provides a balanced reflection.

> *Learning the block system has its advantages and disadvantages. The advantage is that I remember things quickly because I repeat them every day. The disadvantage is that if I miss one class, I feel like I've fallen behind a lot. Fortunately, the teacher likes to give additional explanations, and my friends also help me.*

Based on the interviews, there are several weaknesses and strengths that have been explained by the third student. The weakness of the block course system occurs not because of the learning process, but because of student absenteeism. There are several strengths of the block course system, such as the repetition of material every day and additional explanations for those who do not understand the concepts taught. The students' statements show that this system is adaptive despite facing various challenges.

From the above description, it can be seen that mathematics learning through block courses at Yanyawit School presents unique dynamics. The school emphasizes a balance between academics, religion, and recreation. Teachers feel supported in developing more in-depth learning, while students report a variety of experiences, ranging from feeling focused and tired to being more motivated. This indicates that block courses are not merely a scheduling system but also an approach that fosters an intensive, focused, and enjoyable learning culture.

Research Findings 2. Quantitative Analysis Result

The Mathayom Ton 1 students' mathematics learning outcome data show the distribution of scores, which can be seen in Table 2. These figures illustrate the distribution of mathematical concept understanding among students and form the basis for further quantitative analysis.

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Table 2. Frequency Distribution of MathayomTon 1 Students' Mathematics Learning Outcomes

Grade Interval	Frequency
51 – 56	9
57 – 62	5
63–68	9
69–74	1
75–80	3
81–86	2
Total	**29**

The frequency distribution of mathematics scores for students at MathayomTon 1 Yanyawit School in Thailand shows that out of a total of 29 students, the highest number of scores were in the range of 51 – 56, with 9 students. The score range of 63 – 68 also had the same number of students, with 9 students. Furthermore, the score range of 57 – 62 covers 5 students, while the score range of 75 – 80 consists of 3 students. The score range of 69 – 74 is filled by 1 student, and the score range of 81 – 86 has 2 students. The data can be visualized in the form of a graph to facilitate the analysis of student score distribution.

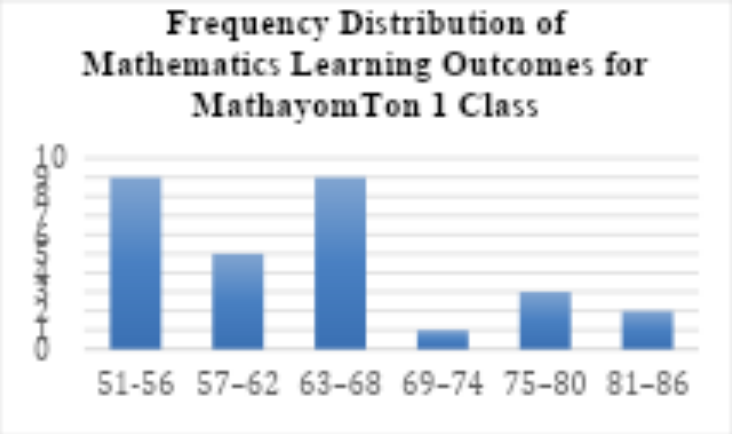

Figure 2. Frequency Distribution of MathayomTon 1 Students' Mathematics Learning Outcomes

From Table 2 and Figure 2, this distribution indicates that most students obtained scores in the moderate category, with the highest concentration in the 51 – 56 and 63 – 68 intervals. This shows that the majority of student achievement is around the mid-range, although there are also some students who scored in the higher category (75 – 80 and 81 – 86) and the lower category (69 – 74). From both

It is known that there are 29 students with a minimum score of 51 and a maximum score of 81. Thus, the mean is 63.38, while the median is 63. The most frequently occurring mode is 51, and the standard deviation is 8.90, which indicates variation in student scores from the average. Thus, from this data, it can be grouped into various categories based on the following image representing the frequency distribution of score categories.

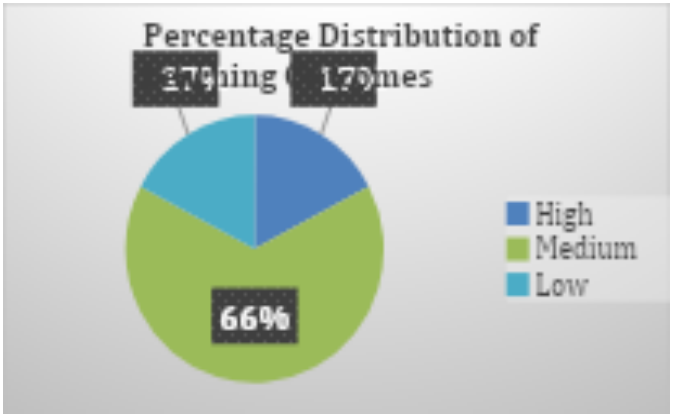

Figure 3. Percentage Distribution of Learning Outcome Distribution

Based on the frequency distribution of scores, it was found that there were 5 students or 17.2% who were in the high category, i.e., they had scores above 72.28. The medium category was the majority with 19 students or 65.5%, whose scores were in the range of 54.48 to 72.28. Meanwhile, the low category consists of 5 students or 17.2% with scores below 54.48. Thus, the majority of students obtained medium scores, indicating that most of them achieved an adequate understanding of the material, while a small number achieved high or low scores.

Discussion

The implementation of mathematics learning through *block courses* at Yanyawit School allows teachers to manage material in a more sequential and systematic manner within a duration of 125 minutes per session, so that explanations, exercises, and class discussions can be carried out intensively (Fadhilah et al., 2022). This long duration improves concept understanding, learning process effectiveness, and student learning outcomes (Safitri et al., 2024; Widarto et al., 2024), as well as providing space to assess cognitive skills based on Bloom's taxonomy, ranging from remembering to creating (Ratno et al., 2024). In addition, the long duration also supports the development of critical thinking skills, although the success of implementing *block courses* still depends on creative classroom management (Jatmoko et al., 2024). This is in line with the results of Rusmitaningsih's (2020) research that a *mastery learning*-based block system improves conceptual understanding gradually, so that the effectiveness of *block courses* is also determined by school policy support that regulates their implementation.

School policies that combine academic, spiritual, and recreational activities have been proven to maintain a balance in learning. *Block course* schedules interspersed with religious and sports days help students maintain focus while shaping their character. These findings are in line with Widarto et al. (2024),who emphasize that the flexibility of block schedules increases learning effectiveness, and Nabilah et al. (2021),who show that a balance of activities has a positive impact on achievement. Support for this policy also strengthens the role of teachers in creating an active and enjoyable learning atmosphere, which ultimately influences the learning experience of students.

This policy support then had implications for students' varied responses to *block courses.* Some students felt helped because the intensity of the meetings strengthened their understanding, while others experienced boredom due to the long duration. This condition is in line with Nurhaliza et al. (2025), who stated that the block system increases engagement but also has the potential to cause fatigue. Therefore, a variety of methods such as discussions, games, and contextual projects, need to be applied (Ipa, 2022; Pertiwi et al., 2023; Yudianto et

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al., 2020). The learning outcomes, which were mostly in the moderate category, indicate that *block courses* are quite effective, but further innovation is needed to improve academic outcomes, as also shown by Khairunnisa et al. (2023),that contextual and enjoyable approaches can improve learning motivation.

In view of these findings, further research is recommended to examine three aspects: (1) the integration of *block courses* with national and local curricula; (2) the development of activity-based teaching modules tailored to longer learning periods; and (3) the application of innovative methods such as *project-based learning* or *game-based learning.* In addition, subsequent research is also recommended to conduct more in-depth statistical tests to determine the accuracy of the relationship between the implementation *of block courses* and student learning outcomes. This study is expected to provide a more objective picture of the potential and effectiveness of implementing *block courses* in improving mathematics learning outcomes in various educational contexts.

Conclusion

The unveiling of block classes at Yanyawit School in Thailand has cultivated a more concentrated, intensive, and structured learning atmosphere. The five-week observation period qualitatively indicated that the 125-minute sessions facilitated sequential material delivery and comprehensive conversations, however issues such as student disengagement and academic deficiencies resulting from absence remained. Quantitative descriptive analysis indicates that the majority of students achieved a mean score of 63.38. Although these findings demonstrate that block courses facilitate the understanding of fundamental mathematical concepts for the majority of students, the clustering of scores in the mid-range, in the absence of comparative or inferential data, implies that the system's efficacy is not yet maximized for all levels of ability. This study enhances the current literature by presenting a distinct model illustrating how block-course scheduling might function as a pedagogical link to align national academic requirements with religious-based curricula within a Thai vocational framework. This method provides significant insights into managing classroom dynamics via prolonged instructional periods. In light of these findings, it is advisable for educators to vary instructional strategies by integrating gamification and interactive digital media to alleviate student tiredness, while students should uphold consistent attendance due to the cumulative and intensive characteristics of the block system. Future researchers are urged to advance beyond descriptive statistics by performing inferential statistical tests to ascertain the correlational or causative relationship between block course implementation and long-term learning outcomes, in addition to creating specialized activity-based modules. Moreover, schools are anticipated to offer strategic assistance via equitable scheduling practices and diverse learning tools to cultivate a synergy that improves the overall quality of mathematics teaching.

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Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

N.F.R. Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration.

Data Availability Statement

The authors state that the data supporting the findings of this study will be made available by the corresponding author, [N.F.R.], upon reasonable request.

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