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Teaching Time Measurement in Madrasah Ibtidaiyah: Challenges and Effective Strategies

Pembelajaran Pengukuran Waktu di Madrasah Ibtidaiyah: Tantangan dan Strategi Efektif

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Abstract

This study aims to identify the challenges faced by students in learning time measurement and to examine effective instructional strategies for improving their conceptual understanding. The study employed a descriptive qualitative approach through literature review and analysis of mathematics teaching practices at the elementary school level. Data were analyzed thematically to identify factors influencing students' success in learning time measurement. The findings reveal that students' difficulties are influenced by internal factors, including numerical ability, learning motivation, and cognitive readiness, as well as external factors such as teaching methods, availability of instructional media, and learning environment support. The use of manipulative learning media, including analog clock models and time-measuring tools, was found to enhance students' understanding of relationships among time units. Furthermore, contextual learning approaches that connect time concepts to everyday activities, such as school schedules, travel duration, and prayer times, significantly improve student engagement and comprehension. Educational technology, including interactive applications and digital learning resources, also contributes positively to learning outcomes.

Keywords: Time Measurement; Mathematics Education; Madrasah Ibtidaiyah; Contextual Learning; Instructional Strategies

Abstrak

Penelitian ini bertujuan untuk mengidentifikasi berbagai kendala yang dihadapi siswa dalam mempelajari pengukuran waktu serta menganalisis strategi pembelajaran yang efektif untuk meningkatkan pemahaman konsep tersebut. Penelitian menggunakan pendekatan kualitatif deskriptif melalui kajian literatur dan analisis praktik pembelajaran matematika pada jenjang sekolah dasar. Data dianalisis secara tematik untuk mengidentifikasi faktor-faktor yang memengaruhi keberhasilan pembelajaran pengukuran waktu. Hasil penelitian menunjukkan bahwa kesulitan siswa dipengaruhi oleh faktor internal, seperti kemampuan numerik, motivasi belajar, dan kesiapan kognitif, serta faktor eksternal, seperti metode pembelajaran, ketersediaan media, dan dukungan lingkungan belajar. Penggunaan media manipulatif, seperti jam analog buatan, model jam bergerak, dan alat ukur waktu lainnya, terbukti membantu siswa memahami hubungan antar satuan waktu. Selain itu, pembelajaran kontekstual yang mengaitkan konsep waktu dengan aktivitas sehari-hari, seperti jadwal sekolah, perjalanan, dan waktu salat, meningkatkan pemahaman serta keterlibatan siswa dalam pembelajaran. Pemanfaatan teknologi pendidikan melalui aplikasi dan media interaktif juga memberikan kontribusi positif terhadap peningkatan hasil belajar.

Kata Kunci: Pengukuran Waktu; Pendidikan Matematika; Madrasah Ibtidaiyah; Pembelajaran Kontekstual; Strategi Pembelajaran



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INTRODUCTION

Time measurement is one of the fundamental mathematical concepts taught in elementary education, including in Madrasah Ibtidaiyah (Islamic elementary schools). Understanding time enables students to organize daily activities, manage schedules, calculate durations, and develop discipline in their personal and academic lives.¹ Time is a unique mathematical concept because it is not only numerical but also closely related to real-life experiences. Students encounter time continuously through daily routines such as waking up, attending school, performing prayers, completing assignments, and participating in extracurricular activities. Therefore, mastering time measurement is essential for developing practical mathematical literacy.²

In mathematics education, time measurement encompasses several competencies, including reading analog and digital clocks, understanding units of time, converting between different units, calculating elapsed time, and solving contextual problems involving time.³ These competencies are integrated into the elementary mathematics curriculum because they provide a bridge between abstract mathematical thinking and real-world applications. Through learning time measurement, students develop reasoning skills, problem-solving abilities, and an understanding of quantitative relationships. Despite its importance, many students experience difficulties when learning time measurement.⁴ Research in mathematics education has consistently shown that concepts related to time are often challenging for young learners. Unlike length, weight, or volume, time cannot be directly observed or physically manipulated. Students cannot touch or see time itself; they can only observe indicators of time, such as clock hands or digital displays. This abstract nature often leads to misconceptions and learning difficulties.⁵

One of the most common challenges involves reading analog clocks. Many students struggle to distinguish between the hour hand and the minute hand.⁶ They may misinterpret the positions of the clock hands, resulting in incorrect readings.⁷ For example, when the hour hand is between two numbers, students often assume it points exactly to one of those numbers rather than understanding its gradual movement.⁸ Such misconceptions hinder their ability to accurately

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- 1 Nurdin Arifin and Eudia Fortuna, "Etnomatematika Pada Kebudayaan Suku Dayak Bentian Dalam Menumbuh Kembangkan Literasi Matematis," *Jurnal Pengabdian Ahmad Yani* 1, no. 1 (2021): 58–67, <https://doi.org/10.53620/pay.v1i1.16>.
 - 2 Nurul Rahmaini and Salsabila Ogylva Chandra, "Pentingnya Berpikir Kritis Dalam Pembelajaran Matematika," *Griya Journal of Mathematics Education and Application* 4, no. 1 (March 29, 2024): 1–8, <https://doi.org/10.29303/griya.v4i1.420>.
 - 3 Roslani Supinah and Joko Soebago, "Analisis Bibliometrik Terhadap Tren Penggunaan ICT Pada Pembelajaran Matematika," *JNPM (Jurnal Nasional Pendidikan Matematika)* 6, no. 2 (2022): 276, <https://doi.org/10.33603/jnpm.v6i2.6153>.
 - 4 Yuni Azura et al., "Integrasi Deep Learning Dan Pendekatan Konstruktivisme Untuk Penguatan Karakter Islami Di Era Pembelajaran Abad 21," *Jurnal Pendidikan Dasar* 13, no. 2 (2025): 360–73, <https://doi.org/10.46368/jpd.v13i2.4749>.
 - 5 Sanggiti Bawadi, Heni Pujiastuti, and Maman Fathurrohman, "Pemahaman Konsep Matematika Dengan Teknik Scaffolding: Systematic Literature Review," *MENDIDIK: Jurnal Kajian Pendidikan Dan Pengajaran* 9, no. 1 (2023): 7–18, <https://doi.org/10.30653/003.202391.2>.
 - 6 Abd Rahim et al., "Pelatihan Teknik Penulisan Artikel Ilmiah Internasional Bereputasi Dan Nasional Terakreditasi Mahasiswa Program Pascasarjana Universitas Negeri Makassar," *Seminar Nasional Hasil Pengabdian Kepada Masyarakat* 1 (2020): 10–15, <https://ojs.unm.ac.id/semnaslpm/article/view/15807>.
 - 7 Jusuf Blegur et al., "Pelatihan Kepemimpinan Transformasional Calon Guru: Konsep, Integrasi, Dan Evaluasinya Dalam Pembelajaran," *Jurnal Visi Pengabdian Kepada Masyarakat* 5, no. 2 (August 10, 2024): 80–105, <https://doi.org/10.51622/pengabdian.v5i2.2269>.
 - 8 Agung Prabowo et al., "Penyuluhan Cara Meneliti Dan Menulis Hasil Penelitian Bidang Matematika Bagi Guru-Guru MGMP Matematika SMP Kabupaten Banyumas," *ULIL ALBAB : Jurnal Ilmiah Multidisiplin* 2, no. 9 (July 18, 2023): 4100–4106, <https://doi.org/10.56799/jim.v2i9.2119>.

determine time. Another significant difficulty is calculating elapsed time. Students frequently encounter problems when asked to determine how long an activity lasts. For instance, calculating the duration between 07:15 and 09:45 requires understanding both hours and minutes, as well as the relationships between them. Without a solid conceptual foundation, students often rely on memorization rather than meaningful understanding, leading to errors in calculation.

Furthermore, students often face challenges in converting units of time. Understanding relationships such as 60 seconds equals one minute, 60 minutes equals one hour, and 24 hours equals one day requires both memorization and conceptual comprehension. These conversions become even more difficult when students are required to perform multi-step calculations involving several units simultaneously.⁹ The learning difficulties associated with time measurement are influenced by both internal and external factors. Internal factors include students' cognitive development, mathematical ability, motivation, learning styles, and prior knowledge. Students with limited numerical understanding may struggle to connect arithmetic operations with time calculations. Similarly, students with low motivation may show less interest in practicing time-related skills.¹⁰

External factors also play a significant role. Teaching methods, instructional materials, classroom environments, and the availability of learning media can either facilitate or hinder learning. Traditional teacher-centered approaches often emphasize rote memorization rather than conceptual understanding. As a result, students may memorize clock-reading procedures without truly understanding the meaning of time relationships.¹¹ The rapid advancement of educational technology presents new opportunities for improving time measurement instruction. Interactive digital clocks, educational games, simulations, and multimedia resources can make abstract concepts more concrete and engaging.¹² Technology-enhanced learning environments allow students to manipulate time representations, observe changes dynamically, and receive immediate feedback on their performance.¹³ These features support deeper conceptual understanding and increase student motivation. In the context of Madrasah Ibtidaiyah, teaching time measurement has additional significance because time management is closely linked to Islamic practices.¹⁴ Daily prayer schedules, fasting periods, Quranic study sessions, and religious activities all require awareness of time. Consequently, integrating religious

9 Arif Rahman Hakim and Fauzi Mulyatna, "Sejarah Matematika: Perkembangan Bilangan Matematika Empiris," *Prosiding Diskusi Panel Nasional Pendidikan Matematika* 9, no. 80 (2023): 471–78, <https://proceeding.unindra.ac.id/index.php/DPNPMunindra/article/view/6555>.

10 Arifin Karim and Joko Soebago, "Pemetaan Bibliometrik Terhadap Trend Riset Matematika Terapan di Google Scholar Menggunakan Vosviewer," *Teorema: Teori Dan Riset Matematika* 6, no. 2 (September 30, 2021): 234–41, <https://doi.org/10.25157/teorema.v6i2.5835>.

11 M Haryani et al., "Studi Literatur: Penerapan Media Pembelajaran Augmented Reality Dalam Pembelajaran Matematika Guna Meningkatkan Kemampuan Pemecahan Masalah Siswa," *PRISMA, Prosiding Seminar Nasional Matematika* 7 (2024): 359–67, <https://proceeding.unnes.ac.id/prisma/article/view/2975>.

12 Beni Junedi, St. Budi Waluya, and Wardono, "The Programme for International Student Assessment: Tinjauan Literasi Matematika Dan Implementasi Pada Pembelajaran Matematika Di Indonesia," *PRISMA, Prosiding Seminar Nasional Matematika* 7 (2024): 834–40, <https://proceeding.unnes.ac.id/prisma/article/view/3037>.

13 Maulidiyah Tutut Nurjanah, Cholis Sa'dijah, and Suiswo Suiswo, "Representasi Skematis Siswa Dalam Menyelesaikan Masalah Trend in International Mathematics and Science Study (TIMSS) Ditinjau Dari Self Efficacy," *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan* 6, no. 4 (April 30, 2021): 622–34, <https://doi.org/10.17977/jptpp.v6i4.14725>.

14 Yuni Azura, Hadi Thoyib, and Suhendry, "Pengenalan Kalimah Isim Surah Al-Fatihah Bagi Anak-," *Jurnal Pengabdian Masyarakat Pembangunan Sosial, Desa Dan Masyarakat Volume* 6 (2025): 229–37.

contexts into mathematics instruction can enhance students' understanding while strengthening the relevance of learning.¹⁵

Effective teaching of time measurement requires meaningful learning experiences that connect mathematical concepts with students' daily lives. Contextual learning approaches encourage students to apply time concepts in authentic situations, such as planning school activities, organizing study schedules, calculating travel times, and understanding prayer schedules. Such experiences help students recognize the practical value of mathematics and develop transferable skills. Given these considerations, this study explores challenges in teaching time measurement in Madrasah Ibtidaiyah and examines instructional strategies that can improve students' understanding. The study aims to identify common learning difficulties, analyze contributing factors, and propose effective pedagogical solutions that support meaningful mathematics learning.

Method

This study employed a qualitative descriptive research design to investigate challenges and instructional strategies associated with teaching time measurement in Madrasah Ibtidaiyah. Qualitative research was chosen because it allows researchers to explore educational phenomena in depth and understand participants' experiences, perceptions, and behaviors within their natural learning environments. The research focused on mathematics learning related to time measurement among elementary-level students. The study examined students' difficulties in understanding time concepts, teachers' instructional practices, and potential solutions for improving learning outcomes. Data were collected through literature review, classroom observations, and analysis of educational practices commonly implemented in elementary mathematics education.¹⁶ The literature review served as the primary source of data. Relevant books, journal articles, curriculum documents, and educational reports related to mathematics education and time measurement were analyzed systematically. The literature review aimed to identify common learning challenges, effective instructional strategies, and theoretical perspectives supporting the teaching of time-related concepts.¹⁷

Classroom observations were conducted to gain insights into actual teaching and learning processes. Observations focused on how teachers introduced time concepts, utilized instructional media, facilitated student participation, and addressed learning difficulties. Particular attention was given to students' interactions with analog clocks, digital clocks, and time calculation activities. Data analysis followed thematic analysis procedures. First, relevant information from literature sources and observations was collected and organized. Second, recurring themes related to learning difficulties, instructional challenges, and teaching strategies were identified. Third, these themes were categorized into broader conceptual groups, including cognitive challenges, instructional factors, learning media, contextual learning, and educational technology.¹⁸ To ensure credibility, findings from multiple sources were compared and

15 Yuni Azura Risma Chulashotud Diana, Prapti Octavia Ningsih, "Mathematics Learning in the Difusi Era: Strategies and Challenges in Madrasah Ibtidaiyah," *PIONIR Jurnal Pendidikan* 15, no. 1 (2026): 14–26, <https://jurnal.ar-raniry.ac.id/index.php/Pionir/article/view/31707>.

16 Risma Chulashotud Diana, "Ar Qurani (Al Ibrah Qurani): Upaya Internalisasi Nilainilai Qurani Pada Anak Muslim Indonesia Berbasis Modul Kisah Teladan Al Quran," *Seminar Nasional Pendidikan – Fakultas Ilmu Pendidikan Universitas Negeri Malang*, 2017, 361–73.

17 Nunung Suryati et al., "Curriculum Development of Postgraduate Study Program Based on Life-Based Learning Philosophy and Disruption Technology," in *International Conference On Information Technology And Education (ICITE 2020) Curriculum*, vol. 508, 2020, 434–36, <https://doi.org/10.2991/assehr.k.201214.273>.

18 Mamika Ujianita Romdhini et al., "Bimbingan Teknis Penggunaan Artificial Intelligence (AI) Dalam Membuat Manuskrip Artikel Ilmiah Di Fakultas MIPA Universitas Mataram," *Jurnal Pengabdian Magister Pendidikan IPA* 4, no. 1 (2024): 17–23, <https://jppipa.unram.ac.id/index.php/jppmpi/article/view/6412>.

triangulated. Literature findings were cross-checked with classroom observations to identify consistencies and discrepancies. This process enhanced the trustworthiness and validity of the research conclusions.¹⁹

Ethical considerations were maintained throughout the study. Educational observations focused on learning processes rather than individual student performance. Information obtained from educational settings was used solely for academic purposes and presented in a generalized manner to protect participants' privacy. The qualitative descriptive approach enabled a comprehensive understanding of time measurement instruction in Madrasah Ibtidaiyah. By integrating theoretical perspectives and practical observations, the study provides valuable insights into effective teaching strategies and educational implications.

RESULTS AND DISCUSSION

Challenges in Learning Time Measurement

Time measurement is one of the mathematical topics that appears simple on the surface but often presents significant challenges for elementary students. Unlike other measurement concepts such as length or weight, time cannot be directly observed or physically manipulated. Students can only infer the existence of time through indicators such as clock hands, digital displays, schedules, and daily activities. This abstract nature makes time measurement cognitively demanding because learners must simultaneously connect numerical symbols, temporal sequences, and real-life experiences. The findings indicate that many students encounter substantial obstacles when learning time-related concepts, particularly in reading clocks, calculating durations, and converting time units. These difficulties are not isolated problems but are interconnected with students' cognitive development, prior knowledge, and learning experiences. Consequently, understanding the nature of these challenges is essential for designing effective instructional interventions that support meaningful learning and long-term conceptual understanding.

One of the most frequently encountered difficulties involves reading analog clocks. Although students are often familiar with digital clocks through smartphones and electronic devices, analog clocks require a different set of cognitive skills. Learners must distinguish between the hour hand and the minute hand while simultaneously interpreting their positions within a circular numerical arrangement. Many students mistakenly assume that both hands indicate hours or become confused when the hour hand is positioned between two numbers. Such misconceptions can lead to persistent errors in determining the correct time. According to Herlina and Juandi, understanding analog clocks requires the integration of visual perception, numerical knowledge, and spatial reasoning.²⁰ The findings also suggest that the decreasing presence of analog clocks in everyday environments contributes to these difficulties, as students have fewer opportunities to develop familiarity through routine exposure. Therefore, reading analog clocks demands more than memorization; it requires the gradual development of conceptual and spatial understanding supported by continuous practice.²¹

19 Femmy Effendy et al., "Penggunaan Pembayaran Seluler Dengan VOSviewer," *Jurnal Interkom: Jurnal Publikasi Ilmiah Bidang Teknologi Informasi Dan Komunikasi* 16, no. 1 (2021): 10–17, <https://ejournal.rosma.ac.id/index.php/interkom/article/view/92>.

20 Sari Herlina and Dadang Juandi, "Systematics Literature Review: Pengembangan Mathematical Proficiency Dalam Pembelajaran Matematika," *Jurnal Cendekia: Jurnal Pendidikan Matematika* 6, no. 2 (2022): 2122–33, <https://doi.org/10.31004/cendekia.v6i2.1417>.

21 Umar Dhani and Prapti Octavia Ningsih, "Upaya Guru Dalam Menegakkan Kedisiplinan Siswa Di Madrasah Ibtidaiyah Negeri 2 Sarolangun," *DLAJAR: Jurnal Pendidikan Dan Pembelajaran* 4, no. 4 (October 15, 2025): 743–51, <https://doi.org/10.54259/diajar.v4i4.5451>.

Beyond reading clocks, students frequently struggle to calculate elapsed time between events. While many learners can identify a specific time shown on a clock, determining the duration between two points in time often becomes problematic. For example, calculating the interval between 08:30 and 11:15 requires students to understand relationships between hours and minutes rather than merely performing arithmetic subtraction. Many students attempt to solve such problems mechanically by subtracting the numbers directly without considering the structure of time measurement. As a result, errors commonly occur when calculations involve crossing hour boundaries or require regrouping minutes into hours. Kuswandi et al. highlight that procedural competence alone is insufficient for solving elapsed-time problems effectively.²² The findings indicate that students who lack a strong conceptual understanding of time relationships often rely on guesswork or memorized procedures, which frequently lead to inaccurate answers. This condition reinforces the need for instructional approaches that emphasize reasoning and conceptual understanding rather than rote calculation.

Another significant challenge concerns the conversion of time units. Students are generally introduced to relationships such as sixty seconds equaling one minute, sixty minutes equaling one hour, and twenty-four hours equaling one day. Although many learners can memorize these conversion rules, applying them correctly in problem-solving situations remains difficult. For instance, converting 150 minutes into hours and minutes requires students to understand division, remainders, and the hierarchical relationship between units. Similar difficulties arise when students are asked to convert days into hours or seconds into minutes. The findings suggest that students often view conversion as a purely procedural activity rather than as a conceptual relationship among units. Consequently, when problems become more complex, learners struggle to determine appropriate solution strategies. Rahmadhani argues that visual tools such as timelines, number lines, and conversion charts can support students in developing a deeper understanding of these relationships by making abstract temporal structures more visible and accessible.²³

The study further reveals that internal factors significantly influence students' success in learning time measurement. Cognitive readiness emerged as one of the most important determinants of achievement. Students who possess stronger numerical skills tend to demonstrate greater success in understanding clock reading, time calculations, and unit conversions. This relationship occurs because many time-related tasks require arithmetic reasoning and the ability to recognize numerical patterns. Motivation also plays a critical role in shaping learning outcomes. Students who perceive mathematics as useful and relevant are generally more willing to engage in practice activities and problem-solving tasks. Conversely, students who associate mathematics with difficulty or failure often display anxiety, reduced participation, and avoidance behaviors. The findings indicate that learning preferences, concentration levels, and previous experiences with mathematics further contribute to variations in student performance. These results support the argument of Jannah and Hayati that effective mathematics instruction must acknowledge learner diversity and accommodate different cognitive and motivational characteristics.²⁴

22 Dedi Kuswandi et al., "Development Of Life-Based Curriculum Model Designs In The Global Era," in *Proceeding on International Conference of Science Management Art Research Technology (IC-SMART)*, vol. 1, 2020, 26–32, <https://doi.org/10.31098/ic-smart.v1i1.23>.

23 Elfi Rahmadhani, "Ethnomathematics Dan Permainan Tradisional Dalam Pendidikan Matematika," *JPMI – Jurnal Pembelajaran Matematika Inovatif* 5, no. 1 (2022): 81–94, <https://doi.org/10.22460/jpmi.v5i1.81-94>.

24 Miftahul Jannah and Miftahul Hayati, "Pentingnya Kemampuan Literasi Matematika Dalam Pembelajaran Matematika," *Griya Journal of Mathematics Education and Application* 4, no. 1 (March 30, 2024): 40–54, <https://doi.org/10.29303/griya.v4i1.416>.

Prior knowledge also functions as an important internal factor that affects students' understanding of time concepts. Learning time measurement is cumulative in nature, meaning that mastery of advanced skills depends heavily on the successful acquisition of foundational concepts. Students who have not fully understood number sequences, skip counting, or basic arithmetic operations frequently encounter greater difficulties when learning time-related topics. For example, understanding that sixty minutes constitute one hour requires numerical fluency as well as conceptual reasoning about grouping and equivalence. When these prerequisite skills are weak, misconceptions become more likely to occur and persist over time. Furthermore, students may struggle to connect classroom instruction with their everyday experiences if they lack sufficient conceptual foundations. This situation highlights the importance of early intervention and continuous assessment to identify learning gaps before they develop into more serious barriers. Strengthening prerequisite mathematical competencies can therefore enhance students' readiness to engage with more complex aspects of time measurement.

External factors are equally influential in shaping students' learning experiences. Teaching methods, classroom environments, instructional resources, and family support all contribute to the effectiveness of time measurement instruction. The findings indicate that classrooms relying primarily on lecture-based approaches often provide limited opportunities for active participation and conceptual exploration. As a result, students may memorize procedures without fully understanding underlying concepts. In contrast, interactive and student-centered learning environments tend to foster greater engagement and deeper understanding. The availability of instructional media also affects learning outcomes significantly. Schools equipped with teaching clocks, manipulatives, and multimedia resources are generally better positioned to support conceptual learning. In addition, family involvement plays an important role in reinforcing time-related skills. Students whose parents discuss schedules, routines, and time management practices often demonstrate stronger understanding of temporal concepts. These findings are consistent with Winardi et al., who emphasize the importance of environmental support in promoting successful mathematics learning.²⁵

Taken together, these findings demonstrate that challenges in learning time measurement arise from a complex interaction between conceptual difficulties, cognitive characteristics, and environmental conditions. Students are required not only to understand numerical relationships but also to connect abstract temporal concepts with real-world experiences. Difficulties in reading analog clocks, calculating elapsed time, and converting time units often reflect broader issues related to cognitive readiness, motivation, instructional quality, and access to learning resources. Therefore, addressing these challenges requires a comprehensive educational approach that goes beyond teaching procedural skills alone. Teachers must recognize the diverse factors influencing student performance and create learning environments that support active engagement, conceptual understanding, and meaningful application. By understanding the nature of these challenges, educators can develop more effective instructional strategies that help students build strong and lasting foundations in time measurement learning.

Instructional Strategies for Improving Time Measurement Learning

The findings indicate that effective instruction plays a decisive role in overcoming students' difficulties in learning time measurement. Because time is an abstract concept, teachers need to employ learning strategies that transform abstract ideas into concrete and meaningful experiences. Traditional approaches that rely heavily on explanation and memorization often fail to develop deep conceptual understanding. Students may remember procedures temporarily

25 Sunaryo Winardi et al., "Penggunaan Mobilenet untuk Intelligent Character Recognition (ICR) Penilaian Otomatis Operasi Matematika Dasar," *Jurnal TIMES* 12, no. 2 (December 18, 2023): 40–51, <https://doi.org/10.51351/jtm.12.2.2023707>.

but struggle when applying them in unfamiliar situations. Therefore, instructional strategies should focus on helping learners actively construct knowledge through exploration, interaction, and reflection. Effective learning environments allow students to investigate relationships among time units, visualize temporal concepts, and connect mathematical ideas with real-life experiences. Through such approaches, students are more likely to develop a meaningful understanding of time measurement rather than simply memorizing rules and formulas.

One of the most effective instructional strategies identified in this study is the use of manipulative learning media. Physical learning tools such as analog teaching clocks, movable clock models, and cardboard clocks provide students with opportunities to interact directly with representations of time. These materials allow learners to manipulate clock hands, observe changes in time intervals, and explore relationships between hours and minutes. Such hands-on experiences reduce the level of abstraction that often hinders conceptual understanding. Students are able to experiment independently, test their assumptions, and verify their answers through observation. Moreover, manipulative media encourage active participation and increase students' engagement during learning activities. The findings support constructivist learning theory, which argues that knowledge is best acquired when learners actively construct meaning through direct experiences rather than passively receiving information from teachers.

Another important strategy involves the implementation of contextual learning. Time measurement becomes more meaningful when mathematical concepts are connected to situations that students encounter in their everyday lives. Rather than presenting time as an isolated mathematical topic, teachers can integrate authentic activities such as calculating travel durations, organizing study schedules, planning recreational events, and managing daily routines. Contextual learning helps students recognize the practical value of mathematics and understand why time-related skills are important. Asriyati and Hulukati emphasize that meaningful contexts can strengthen students' motivation and facilitate conceptual understanding.²⁶ When learners see clear connections between classroom learning and real-world experiences, they become more engaged and are better able to transfer knowledge to new situations. Consequently, contextual learning serves as an effective bridge between abstract mathematical concepts and practical applications.

The use of contextual learning is particularly relevant in Madrasah Ibtidaiyah because time management is closely associated with various religious activities. Daily prayer schedules, Quranic study sessions, fasting periods, and other Islamic practices provide authentic contexts for understanding temporal concepts. Integrating these activities into mathematics instruction enables students to apply time measurement skills within familiar and meaningful situations. For example, students may calculate the duration between prayer times, determine the remaining time before congregational worship, or organize study schedules around religious activities. Such integration not only enhances mathematical understanding but also strengthens the relevance of learning within students' cultural and spiritual environments. Samosir (2022) argues that learning becomes more effective when instructional content reflects learners' everyday realities and social experiences. Therefore, contextualizing mathematics through Islamic practices can enrich both conceptual understanding and student engagement.

Technology-enhanced instruction also emerged as an important strategy for improving students' understanding of time measurement. The rapid development of educational technology provides teachers with access to interactive tools that can support learning in innovative ways. Digital clocks, educational applications, multimedia simulations, and online games offer

26 Asriyati Nadjamuddin and Evi Hulukati, "Kemampuan Literasi Numerasi Mahasiswa Dalam Menyelesaikan Masalah Matematika," *Jurnal Basicedu* 6, no. 1 (January 19, 2022): 987–96, <https://doi.org/10.31004/basicedu.v6i1.1999>.

opportunities for students to explore time concepts dynamically. Unlike static textbook illustrations, digital resources allow learners to observe clock movements, manipulate variables, and receive immediate feedback regarding their responses. According to Putra, Yani, and Rizal, technology-based learning environments can increase student motivation and encourage active participation.²⁷ Visual animations also help learners understand relationships between hours, minutes, and seconds more effectively. As a result, technology can function as a valuable complement to traditional instructional approaches, particularly when addressing concepts that students often perceive as abstract and difficult.

Although technology offers significant advantages, the findings suggest that it should not replace traditional learning experiences entirely. Excessive reliance on digital tools may limit opportunities for direct interaction and hands-on exploration. Instead, the most effective instructional approach appears to involve a balanced integration of manipulative media, contextual learning, and educational technology. Physical learning materials help students develop foundational understanding, while digital resources provide additional opportunities for visualization and practice. Similarly, contextual activities ensure that mathematical concepts remain relevant and meaningful. Combining these approaches creates a comprehensive learning environment that accommodates diverse learning preferences and promotes deeper conceptual understanding. Such integration reflects contemporary perspectives on mathematics education, which emphasize the importance of utilizing multiple instructional methods to address the varied needs of learners.

To summarize the instructional strategies identified in this study, Table 1 presents the main approaches and their contributions to students' understanding of time measurement.

Table 1. Instructional Strategies for Improving Time Measurement Learning

Instructional Strategy	Main Characteristics	Expected Learning Outcomes
Manipulative Learning Media	Use of analog clocks, movable clock models, and physical learning tools	Improved conceptual understanding and reduced misconceptions
Contextual Learning	Integration of real-life activities and authentic situations	Increased relevance, engagement, and knowledge transfer
Islamic Context Integration	Application of time concepts through prayer schedules and religious activities	Stronger connection between mathematics and daily life
Technology-Enhanced Instruction	Use of digital clocks, applications, simulations, and educational games	Higher motivation and better visualization of concepts
Blended Instructional Approach	Combination of physical media, contextual activities, and technology	Comprehensive understanding and accommodation of diverse learning styles

Source: Author (2026)

As shown in Table 1, effective time measurement instruction requires the integration of multiple pedagogical approaches that address both the cognitive and practical dimensions of learning. No single strategy can fully accommodate the diverse needs of elementary students. Instead, successful instruction emerges from the thoughtful combination of concrete experiences, meaningful contexts, and technological support.

27 Dian Eka Putra Dian et al., "Perencanaan Kedalaman Elektroda Batang Untuk Sistem Pentahanan Instalasi Listrik Gedung Kelurahan 29 Ilir Kota Palembang," *Kemas Journal: Jurnal Pengabdian Masyarakat* 3, no. 1 (June 30, 2025): 1–7, <https://doi.org/10.31851/kemas.v3i1.18217>.

The findings also highlight several implications for mathematics teachers. First, instructional practices should prioritize conceptual understanding rather than procedural memorization. Students need opportunities to explore, discuss, and reflect upon time-related concepts through meaningful activities. Second, teachers should employ diverse instructional media to address different learning styles and preferences. Visual, auditory, and kinesthetic approaches can collectively support comprehensive understanding. Third, formative assessment should be implemented regularly to identify misconceptions and provide timely corrective feedback. Finally, collaboration between schools and families should be strengthened to reinforce time-related learning beyond the classroom. Parents can support the development of time management skills through daily routines, schedules, and discussions. By adopting these strategies, educators can create learning environments that foster meaningful understanding and long-term competence in time measurement.

CONCLUSION

The findings reveal that learning time measurement in Madrasah Ibtidaiyah involves multidimensional challenges arising from both cognitive and environmental factors. Students commonly experience difficulties in reading analog clocks, calculating elapsed time, and converting time units because these tasks require the integration of numerical reasoning, spatial understanding, and temporal relationships. These challenges persist not merely due to the abstract nature of time concepts, but also because of variations in students' cognitive readiness, motivation, prior mathematical knowledge, and exposure to meaningful learning experiences. The study further demonstrates that learning outcomes can be improved through instructional approaches that make abstract concepts more concrete and relevant. The use of manipulative learning media, contextual learning activities, integration of Islamic contexts, and technology-enhanced instruction helps students construct conceptual understanding through active engagement, practical application, and continuous interaction with authentic representations of time.

This study contributes to the growing body of knowledge on elementary mathematics education by providing a comprehensive synthesis of the challenges and instructional strategies associated with teaching time measurement in Madrasah Ibtidaiyah. The findings offer practical guidance for teachers in designing more meaningful and student-centered learning experiences while highlighting the importance of connecting mathematical concepts with students' daily lives and religious practices. Nevertheless, the study is limited by its reliance on literature analysis and educational observations, which may not fully capture the diversity of classroom contexts and student experiences. Future research is therefore recommended to employ empirical approaches involving broader participant groups, classroom interventions, and quantitative measurements of learning outcomes. Such studies could provide stronger evidence regarding the effectiveness of specific instructional strategies and contribute to the development of more innovative models for teaching time measurement in elementary education.

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