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Analysis of the Kurikulum Merdeka on plane figures: A case study of elementary school students

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ABSTRACT

The implementation of the Kurikulum Merdeka in mathematics education. This study aims to provide opportunities to apply a contextual approach grounded in the surrounding environment. This study highlights the use of concrete objects, such as bottle caps, pencil boxes, and folded paper, as learning media that help students understand geometric concepts more tangibly. Using a case study method, data were collected through observation, interviews, and documentation of a teacher and three fourth-grade students. The results show that this approach not only strengthens students' understanding but also increases their active involvement in the learning process. Teachers have the flexibility to design creative learning strategies tailored to students' needs. However, constraints such as limited time and students' readiness to bring learning materials from home remained. Evaluation was conducted both formatively and reflectively, focusing on the exploration process and concept understanding. Therefore, improved teacher training and support from parents and school authorities are needed to strengthen the implementation of contextual learning. Overall, this approach is considered effective in creating a fun, relevant, and meaningful mathematics learning environment for elementary school students.

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ABSTRAK

Penerapan Kurikulum Merdeka dalam pembelajaran Matematika, khususnya materi bangun datar di sekolah dasar. Penelitian ini bertujuan untuk memberikan peluang dalam menerapkan pendekatan kontekstual berbasis lingkungan sekitar. Studi ini menyoroti penggunaan benda konkret seperti tutup botol, kotak pensil, dan kertas lipat sebagai media pembelajaran yang dapat membantu murid memahami konsep geometri secara lebih nyata. Menggunakan metode studi kasus, data dikumpulkan melalui observasi, wawancara, dan dokumentasi terhadap seorang guru dan tiga murid kelas IV. Hasilnya menunjukkan bahwa pendekatan ini tidak hanya memperkuat pemahaman murid, tetapi juga meningkatkan keterlibatan aktif mereka dalam proses belajar. Guru memiliki keleluasaan dalam merancang strategi pembelajaran yang kreatif dan sesuai kebutuhan murid. Meskipun demikian, kendala seperti terbatasnya waktu dan kesiapan murid dalam membawa media pembelajaran dari rumah masih ditemukan. Evaluasi dilakukan secara formatif dan reflektif, dengan fokus pada proses eksplorasi dan pemahaman konsep. Oleh karena itu, peningkatan pelatihan guru dan dukungan dari orang tua serta pihak sekolah diperlukan untuk memperkuat pelaksanaan pembelajaran kontekstual. Secara keseluruhan, pendekatan ini dinilai efektif dalam menciptakan suasana belajar Matematika yang menyenangkan, relevan, dan bermakna bagi murid sekolah dasar

Kata Kunci: *bangun datar; kurikulum merdeka; pembelajaran konseptual*

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INTRODUCTION

Basic education is a crucial initial stage in building the foundations of students' cognitive abilities, attitudes, and skills. One subject that plays a significant role in shaping logical and systematic thinking is Mathematics (Witono & Hadi, 2025). Mathematics is a core subject in elementary school that is essential for developing students' rational, analytical, and systematic thinking skills from an early age (Mahmud & Drus, 2023). One of the topics taught at the elementary level is plane geometry, which includes fundamental geometric concepts such as squares, rectangles, triangles, and circles (Ningrum et al., 2023). Although Mathematics has been taught since elementary school, in reality many students still experience difficulties in understanding concepts, particularly in geometry topics such as plane figures. These difficulties are often caused by instructional approaches that are abstract and insufficiently connected to students' real-life experiences. This condition raises questions about how the implementation of more concrete and contextual learning strategies can help overcome these challenges. Such an approach aligns with the spirit of Kurikulum Merdeka, which emphasizes differentiated learning based on direct experience and relevance to students' real-life contexts (Waruwu & Bilo, 2024).

Kurikulum Merdeka provides opportunities for teachers to be more creative in selecting learning models, strategies, and media that align with students' characteristics and needs (Fadhil & Gusmaneli, 2025). In the context of plane geometry, the use of concrete objects such as books, whiteboards, tables, bottle caps, or other items available in the surrounding environment can serve as effective learning media to bridge students' understanding of basic geometric concepts (Hendroanto & Fitriyani, 2021). This strategy is considered capable of reducing students' difficulties in understanding the properties and characteristics of plane figures, while also increasing their active engagement in the learning process. However, the implementation of this approach has rarely been specifically studied, particularly within the framework of the Kurikulum Merdeka. Therefore, in-depth studies are needed to examine how the Kurikulum Merdeka is actually implemented in teaching plane geometry using everyday objects at the elementary school level, including its effectiveness and the challenges faced by both teachers and students. This strategy is also regarded as effective in reducing students' difficulties in understanding the properties and characteristics of plane figures, as well as enhancing their active participation in the learning process (Jablonski & Ludwig, 2023).

The implementation of Kurikulum Merdeka in elementary schools has become a focus of various studies in recent years. Research highlights how teachers implement the Kurikulum Merdeka in Mathematics in general, revealing that most teachers still rely on textbooks without developing contextual approaches (Rahmawati et al., 2023). Another case study found that the application of differentiated learning, which is a key characteristic of the Kurikulum Merdeka, still faces pedagogical challenges (Sari et al., 2023). Meanwhile, the use of concrete media in teaching plane geometry has been proven to enhance students' understanding of geometric concepts (Nazulfah et al., 2024). The novelty of this study lies in its in-depth examination of the process of selecting concrete objects sourced from students' surrounding environments, such as bottle caps, plates, origami paper, and floor tiles, as instructional tools for teaching plane geometry. This study not only identifies the

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types of objects used but also analyzes teachers' considerations in determining the suitability of these objects in terms of shape, size, function, and availability with the geometric concepts being taught. This approach differs from previous studies that generally focus on the overall effectiveness of concrete media, as this research emphasizes the direct connection between students' everyday experiences and learning materials. Therefore, this study is expected to enrich contextual learning strategies based on Kurikulum Merdeka, which emphasizes the utilization of local resources to enhance students' understanding and active engagement.

LITERATURE REVIEW

Kurikulum Merdeka

The Kurikulum Merdeka was implemented starting in the 2022/2023 academic year as a response to the need for more flexible learning, relevance to real-life contexts, and a student-centered approach. This curriculum replaces the Basic Competencies (Kompetensi Dasar/KD) system with Learning Outcomes (Capaian Pembelajaran/CP) organized by phases, thereby providing teachers with greater flexibility to develop learning strategies that align with students' characteristics and their surrounding environment. Kurikulum Merdeka has the potential to increase student participation in Mathematics learning at the elementary school level through more contextual approaches. However, several challenges remain, including limited teacher training and insufficient availability of supporting facilities, as well as a lack of teacher readiness in designing Learning Objectives (Tujuan Pembelajaran/TP) and Learning Objective Sequences (Alur Tujuan Pembelajaran/ATP), and low student enthusiasm (Afiyanti et al., 2025).

Mathematics Learning in Elementary School

Mathematics learning in elementary school is essential for developing students' numerical, geometric, and logical abilities from an early age. Plane geometry topics, such as squares and triangles, are central because they support the understanding of two-dimensional space (Svane et al., 2023). In Kurikulum Merdeka, this material is given greater flexibility by allowing both teachers and students to choose learning approaches that suit their needs. However, its implementation still faces several challenges, including students' low level of understanding, lack of learning motivation, and teachers' difficulties in applying innovative methods. To address these issues, recommended strategies include differentiated learning, the use of visual media and educational games, and teacher training. Collaboration between schools and parents is also important in creating a supportive learning environment. Despite these challenges, the implementation of Kurikulum Merdeka has been shown to enhance students' creativity and participation (Wijaya et al., 2024).

Contextual Learning and the Use of Everyday Objects

Contextual learning aims to connect subject matter with students' real-life experiences, making the learning process more meaningful (Sherinnova et al., 2023). In the context of Mathematics learning, particularly in plane geometry, the use of everyday objects such as lunch boxes, books, floor tiles, and bottle caps can help students understand the shapes and properties of plane figures concretely. This strategy aligns with the principles of the

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Kurikulum Merdeka, which emphasizes active learning and relevance to students' daily lives (Indriani et al., 2024).

A contextual approach that utilizes concrete media can enhance higher-order thinking skills and improve elementary students' Mathematics learning outcomes. In such approaches, students tend to be more enthusiastic and actively engaged when the material is presented through objects familiar to their environment (Sari & Hasanah, 2023). Similar support is found in Suyantana's study, which applies the REACT strategy (Relating, Experiencing, Applying, Cooperating, Transferring) in Mathematics learning. The results show that students can connect the material to their personal experiences, thereby positively affecting their understanding of mathematical concepts (Suyantana et al., 2024). Students also tend to be more active and focused when learning is based on real-world contexts, as they perceive the material as more relevant to their daily lives (Cholily & Usmiyatun, 2024). The implementation of Contextual Teaching and Learning (CTL) has been shown to increase interest in learning while fostering reflective attitudes toward the material studied (Cholily & Usmiyatun, 2024). Therefore, contextual learning based on everyday objects not only strengthens students' understanding of mathematical concepts but also creates an enjoyable and meaningful learning environment, in line with the objectives of the Kurikulum Merdeka (Sulastri, 2022).

The Implementation of Enjoyable Mathematics Learning

In Kurikulum Merdeka, Mathematics learning is directed to be more contextual, active, and enjoyable, particularly at the elementary school level. One prominent approach is the use of everyday objects in teaching plane geometry. This aligns with the principles of environment-based learning, which emphasize the connection between learning materials and students' real-life experiences (Oclarit et al., 2021). The integration of concrete objects into plane geometry helps students understand concepts such as area and perimeter in a more visual and practical way. The use of objects such as bottle caps, food containers, and books to represent plane figures enhances students' active participation and curiosity (Wijayanti & Yanto, 2023). Furthermore, the application of concrete media and contextual strategies in plane geometry learning helps fourth-grade students understand the relationships between elements of shapes, such as sides and angles, more quickly and accurately. Activities such as measuring tables, whiteboards, or classroom floors serve as real examples of how Mathematics is applied in students' daily lives (Fachrudin et al., 2023). Therefore, enjoyable Mathematics learning grounded in everyday objects aligns with the spirit of Kurikulum Merdeka, which positions students as active participants in the learning process. Through this approach, abstract concepts such as plane figures can be understood in concrete, meaningful ways, while also fostering students' numeracy literacy from an early age.

Learning Steps

The Contextual Teaching and Learning (CTL) approach aims to help students understand concepts through direct engagement in situations relevant to their lives (Susilawati et al., 2023). The process begins by connecting new material with students' prior knowledge, followed by inquiry-based activities, collaborative group work as a form of a learning community, and the presentation of real examples or concrete objects. Afterward, students are encouraged to reflect on the learning process they have experienced, and the activities

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conclude with an authentic assessment that evaluates skills comprehensively. In its implementation, teachers can use context-based student worksheets (LKS) designed to encourage exploration of mathematical concepts through everyday objects, such as books, boxes, or stationery.

METHODS

This study employs a case study method to explore the implementation of the Kurikulum Merdeka in teaching plane geometry at the elementary school level. The case study approach was selected to obtain an in-depth understanding of how the curriculum is implemented in real contexts and how students respond to learning strategies based on everyday objects in plane geometry material. The research subjects consisted of one (1) teacher and three (3) fourth-grade students. Data were collected through five stages: (1) identification and determination of the case focus; (2) field data collection; (3) data reduction and categorization; (4) thematic analysis; and (5) data triangulation.

Data were collected through observation, interviews, and documentation. Observations were conducted to record in detail the learning process, teacher-student interactions, and student participation in activities. Subsequently, semi-structured interviews were conducted with the classroom teacher to understand the background of lesson planning, the strategies employed, and the challenges encountered. Interviews were also conducted with three purposively selected students to explore their responses to the learning activities, their understanding of the material, and their comfort in participating in the Kurikulum Merdeka-based learning. Documentation such as lesson plans (RPP), student worksheets (LKS), and students' work were collected as supporting data.

The data were analyzed thematically using an open coding technique, which generated main categories such as: (1) understanding of Kurikulum Merdeka; (2) lesson planning; (3) implementation of learning; (4) creativity in learning media; (5) student engagement and responses; (6) learning evaluation; and (7) support and challenges. These categories were further developed into major themes by identifying recurring patterns and extracting deeper meanings from the field data.

Modifications were made by adjusting the emerging themes based on the local school context and student characteristics, including adapting data collection methods to align with the rhythm of classroom learning.

RESULTS AND DISCUSSION

Results

Understanding of the Kurikulum Merdeka

The teacher demonstrates a comprehensive understanding of the fundamental principles of the Merdeka Curriculum, namely flexibility, contextual learning, and a student-centered approach. In the interview, the teacher stated

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> *" Kurikulum Merdeka adalah kurikulum yang memberikan keleluasaan bagi guru untuk menyesuaikan pembelajaran dengan kebutuhan dan kondisi murid,"*

Observations indicate that the teacher applies an experience-based approach by guiding students to directly observe real objects, which reflects the contextual learning principles characteristic of the Merdeka Curriculum.

Lesson Planning

The teacher designs lesson plans by incorporating exploratory activities and the use of everyday objects. In an interview, the teacher explained:

> *"Saya sengaja mencantumkan benda-benda dari sekitar murid sebagai bagian dari alat bantu pembelajaran,"*

The lesson plan (RPP) documents show that the objectives, activities, and learning media are aligned with the Learning Objective Sequence (ATP). Observations also indicate that the teacher explicitly communicates the learning objectives and implements the stages of exploration, elaboration, and confirmation

Implementation of Learning

The learning process is carried out actively by involving real objects. The teacher facilitates direct exploration and group discussions with students.

> *Saya minta murid menyebutkan benda yang mereka lihat sehari-hari, lalu kami analisis bersama bentuk geometrisnya,"*

Observations show that students bring and use objects such as pencil cases, bottle caps, and origami paper to observe shapes, sides, and angles. The teacher guides students from one group to another, posing questions such as, "How many sides does a particular shape have?"

Creativity in Learning Media

The teacher demonstrates creativity in selecting and modifying instructional media, stating:

> *"Saya memilih benda yang bentuk dasarnya sesuai, seperti tutup botol untuk lingkaran, penghapus untuk persegi panjang,"*
>
> *"Sometimes I modify them, such as cutting cardboard into specific shapes,"*

Observations indicate the use of various supporting tools, such as images, posters, and videos, to enhance students' understanding of plane geometry.

Student Engagement and Responses

Students demonstrate high levels of engagement. In interviews, students stated:

> *" Suka, karena bisa sambil main dan lihat langsung,"*
>
> *"Karena seru, bisa pegang-pegang benda terus diskusi sama teman,"*

Observations indicate that students actively search for objects, draw shapes, identify the characteristics of plane figures, and engage in group discussions. Students appear enthusiastic and even compete to identify shapes from objects around them.

Learning Evaluation

Evaluation is conducted in a formative, context-based manner.

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> *"Saya kombinasikan antara observasi saat kegiatan, hasil tugas kelompok, dan juga refleksi murid,"*

Observations show that the teacher provides feedback throughout the learning process and concludes the session with reflective questions such as: "What objects in your home are shaped like triangles, squares, or circles?" Assessment is carried out through observation of both the learning process and students' outputs, such as drawings and descriptions of shapes

Support and Challenges

The teacher receives support from the school.

> *"Kepala sekolah memberi kebebasan untuk berinovasi dalam kelas,"*

However, the teacher also highlighted several challenges:

> *" Terkadang murid lupa membawa benda yang diminta atau waktu di kelas jadi terbagi untuk eksplorasi,"*

Observations support this statement, as some students appeared confused for not bringing objects from home; however, the teacher addressed this issue by providing backup materials in the classroom.

Assessment During the Learning Process

Assessment is conducted throughout the learning activities using a reflective and dialogic approach. The teacher provides praise and mild corrections when students respond:

> *" Ya, itu benar! Tutup botol memang lingkaran. Tapi coba hitung ada berapa sisi ya?"*

The teacher also evaluates students through exploration tasks and group discussions.

Achievement of Learning Objectives

The learning objectives are well achieved. Students can connect real objects to plane geometry concepts.

> *"Piring itu lingkaran, kotak pensil itu persegi panjang,"*
>
> *" Bisa, kayak penggaris segitiga atau lipatan tisu,"*

Observations show that most students can identify shapes and their characteristics, as well as redraw the observed objects using their basic geometric forms.

Discussion

Teachers' Understanding of the Principles of the Merdeka Curriculum

The findings of this study show that teachers have a deep understanding of the core principles of the Merdeka Curriculum, such as flexibility, contextual learning, and a student-centered approach. One teacher stated that the Merdeka Curriculum provides educators with flexibility to adapt the learning process to students' needs and conditions, thereby reflecting alignment with the curriculum's objectives. These findings are consistent with the view that the Merdeka Curriculum offers opportunities for teachers to design learning strategies that align with students' characteristics and their surrounding environment. Therefore, a strong understanding among teachers becomes a crucial foundation for optimizing the

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implementation of Mathematics learning that is relevant to students' everyday lives (Amara et al., 2024).

Lesson Planning that Integrates Local Context

The teacher develops lesson plans that utilize everyday objects as the primary instructional media. The lesson plan (RPP) documents, which include objectives, activities, and learning media aligned with the Learning Objective Sequence (ATP), reflect the implementation of contextual learning principles. This is consistent with the view that Mathematics learning in elementary schools, particularly in plane geometry, requires a flexible approach to enable students to meaningfully understand two-dimensional space (Svane et al., 2023). By integrating everyday objects into lesson planning, teachers not only adapt the material to students' contexts but also facilitate active, enjoyable learning and character development, as promoted in the Merdeka Curriculum (Ismawati, 2025; Wijaya et al., 2024).

Active Learning Implementation Based on Real Objects

The implementation of learning that involves exploring real objects, such as pencil cases and bottle caps, encourages students to connect plane geometry concepts with their everyday experiences. These findings are consistent with contextual learning theory, which emphasizes the importance of linking subject matter to students' experiences to enhance conceptual understanding (Sherinnova et al., 2023). The use of concrete objects also helps students visualize geometric shapes and their properties more effectively (Indriani et al., 2024). Therefore, this teaching strategy aligns with the CTL approach and the REACT principles, which emphasize learning through direct experience and the application of concepts in real-world contexts (Suyantana et al., 2024).

Teacher Creativity in the Use of Learning Media

The teacher demonstrates creativity by modifying simple materials, such as cardboard, into specific geometric shapes and by using visual media, such as posters and videos (Safitri & Apriliani, 2022). This strategy supports active learning and strengthens students' visual understanding. Concrete media that are familiar to students' environments can enhance higher-order thinking skills and learning outcomes (Fatmaningrum & Jazuli et al., 2025; Sari & Hasanah, 2023). Creative contextual learning also helps students become more focused and enthusiastic (Cholily & Usmiyatun, 2024; Mahbubi & Sa'diyah, 2025). The teacher's creativity in selecting and modifying media reflects the implementation of the Merdeka Curriculum principles, which encourage instructional innovation and make learning more interactive (Rosyiddin et al., 2023).

Student Engagement and Positive Responses

Students show high enthusiasm when learning using real objects, as reflected in their statements describing the activities as enjoyable and interactive. This finding aligns with previous studies indicating that integrating concrete objects into learning plane geometry can increase students' active participation and curiosity (Wijayanti & Yanto, 2023). In addition, activities such as measuring or observing real objects make Mathematics learning more applicable and meaningful. This level of engagement serves as an indicator of the success of contextual learning in creating positive learning experiences (Fachrudin et al., 2023).

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Formative and Reflective Evaluation

The teacher conducts formative evaluation through observation, group tasks, and reflective questions linked to students' daily lives. This approach is consistent with the principles of authentic assessment in the CTL framework, which evaluates students' skills holistically through the learning process rather than solely focusing on outcomes (Susilawati et al., 2023). The use of questions such as "What objects at home are shaped like triangles, squares, or circles?" encourages students to connect the material with their everyday experiences, thereby strengthening knowledge transfer.

Support and Challenges in Implementation

Principal support, which provides teachers with the freedom to innovate, is a key factor in the successful implementation of contextual learning (Erlisa, 2024). However, challenges such as students forgetting to bring required objects and limited time for exploration highlight practical issues that need to be anticipated. Common obstacles in implementing the Merdeka Curriculum include limited teacher readiness, inadequate facilities, and technical constraints in the classroom. The teacher's strategy of providing backup materials represents a relevant form of adaptation to ensure the continuity of the learning process (Afiyanti et al., 2025).

Assessment During the Learning Process and Concept Reinforcement

The teacher conducts ongoing assessment during the learning process through praise, guiding questions, and gentle corrections, reflecting a dialogic learning approach. This method aligns with the objectives of the Merdeka Curriculum, which emphasize students' active involvement as subjects in the learning process (Widhiasti et al., 2022; Oclarit et al., 2021). Through this approach, students do not passively receive knowledge but actively construct understanding through interaction and reflection.

Achievement of Learning Objectives

Most students can identify plane shapes in surrounding objects, describe their characteristics, and redraw them. This indicates that the learning objectives in line with the Merdeka Curriculum have been successfully achieved (Cunha et al., 2024). The implementation of learning based on everyday objects has proven effective in transforming previously abstract concepts into a more concrete understanding. Thus, contextual learning not only strengthens students' comprehension of Mathematics but also creates an enjoyable and relevant learning environment (Sulastri, 2022).

CONCLUSION

This study demonstrates that the Merdeka Curriculum is effectively implemented in teaching plane geometry when supported by contextual planning and the use of concrete media from the surrounding environment. Teachers play a crucial role in designing flexible and engaging learning strategies. The use of real objects helps students understand geometric concepts more concretely and increases their engagement in the learning process. Students can transform direct experiences into abstract understanding, while teachers exhibit creativity in both instructional media and evaluation practices. Nevertheless, challenges such as time constraints and students' readiness still require attention. Overall, the Merdeka Curriculum

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has strong potential to create meaningful learning experiences when implemented reflectively and adaptively.

Based on these findings, it is recommended that educators consistently integrate concrete media from the surrounding environment into Mathematics learning, particularly in teaching plane geometry. This approach is considered effective in bridging students' understanding of abstract concepts through more contextual and meaningful learning experiences. Therefore, continuous professional development for teachers in planning and implementing Merdeka Curriculum-based instruction should be strengthened, especially in applying contextual learning strategies and authentic assessment. For future research, it is suggested that comparative studies be conducted across different school contexts, both in terms of geographical location and student characteristics, to gain a more comprehensive understanding of the effectiveness of contextual approaches within the Merdeka Curriculum. Additionally, classroom action research can serve as an alternative to directly examining the impact of specific strategies on students' learning outcomes and engagement in a sustained manner.

AUTHOR'S NOTE

The authors declare that all content in this article has been prepared originally and is free from any form of plagiarism. The writing of this article was conducted independently without the involvement of any parties that could give rise to a conflict of interest.

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