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Comparison of Conventional and Contextual Mathematics Learning in Elementary Schools

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ABSTRAK

Mathematics learning at the elementary school level plays a strategic role in developing students' logical and critical thinking skills from an early age. However, the conventional approach still dominant in many schools tends to emphasize procedural solutions without building in-depth conceptual understanding. This approach risks separating mathematics from students' real-life contexts. As an alternative, the contextual teaching and learning (CTL) approach has emerged as a model that emphasizes the connection between material and students' everyday experiences. This study aims to compare the two approaches through a literature review method with a descriptive qualitative approach. Data were collected from various accredited academic sources over the past five years. The analysis results indicate that the conventional approach is effective in developing procedural skills, while the contextual approach excels in fostering conceptual understanding, learning motivation, and 21st-century skills. However, CTL requires teacher preparedness and adequate resources. This study recommends an adaptive integration of the two approaches to create more relevant, inclusive, and contextual mathematics learning strategies. The theoretical and practical implications point to the importance of constructivism as the primary foundation in developing meaningful mathematics teaching strategies in elementary schools.

INTRODUCTION

Mathematics learning at the elementary school level plays a fundamental role in shaping students' logical and systematic thinking from an early age. Unfortunately, the dominant learning practice in many schools still employs a conventional approach, namely lectures and repetitive exercises that emphasize solely procedural solutions. This model neglects students' active involvement in constructing meaning and concepts independently. According to Bruner (1966) in Umbara (2020), learning that is solely symbolic without concrete and representational experiences hinders the cognitive development of elementary-aged children. This becomes problematic when students experience difficulty understanding abstract concepts due to a lack of connection to their reality.

In conventional learning, teachers tend to be the sole source of information, while students are positioned as passive recipients of knowledge. This contradicts the principles of constructivism, which emphasize that knowledge is built through direct experience and active interaction with the environment (Salsabila & Muqowim, 2024). The lack of opportunities for exploration and participation in mathematics learning not only causes students to feel bored but also struggles to apply concepts in real-world situations. This learning model widens the gap between conceptual understanding and the application skills essential for mastering mathematics.

In response to the limitations of conventional approaches, a contextual teaching and learning approach (CTL) emerged, emphasizing the relevance of material to students' real-life experiences. Contextual learning seeks to link each mathematical concept to everyday life situations so students understand the "why" a concept is being learned. CTL enables students to construct meaning through active engagement in authentic contexts, making learning not only more engaging but also more meaningful (Misqa et al., 2024). In the elementary school context, this is crucial because students are at the concrete operational stage and require visualization and hands-on experience to understand abstract concepts.

The contextual approach also facilitates critical thinking and problem-solving skills, two competencies essential to a 21st-century curriculum. Various studies have shown that students learning through CTL demonstrate better knowledge transfer skills than those learning through conventional methods (Denaga & Mendoza, 2025; Putri et al., 2025). This is due to the strong connection between the material and the students' socio-cultural environment, which allows for holistic and integrative learning. Furthermore, this approach supports the implementation of the Pancasila Student Profile values within the context of the Independent Curriculum, which emphasizes project-based learning and local contextualization.

However, not all teachers are ready to optimally implement a contextual approach. Some teachers still experience difficulties designing authentic problem-based learning and conducting formative assessments of students' thinking processes. Many elementary school teachers still perceive a contextual approach as more complex and time-consuming than conventional methods (Dharmayanti, 2019). Therefore, ongoing training and curriculum support are essential for a systematic transition from a conventional to a contextual approach.

In this context, comparative research between conventional and contextual learning approaches is crucial to determine the impact of each method on student learning outcomes. Other studies have shown varying results depending on the indicators measured, such as conceptual mastery, problem-solving skills, and learning motivation. Such research can also provide policymakers and educators with concrete insights to develop more effective and adaptive mathematics learning strategies at the elementary school level (Utami, 2024).

Furthermore, comparing these two approaches can also contribute to the development of more flexible and contextual learning models, tailored to students' local characteristics and needs. For example, integrating local wisdom and socio-cultural context into contextual-based mathematics learning not only increases the relevance of the material but also strengthens students' cultural identity and values. This aligns with the holistic and transformative approach to education as mandated by the SDGs for education. Therefore, an approach that focuses not only on quantitative learning outcomes but also on affective and social aspects is needed.

Ultimately, the shift from conventional to contextual learning paradigms not only concerns teaching methodology but also reflects a shift in perspective on the learning process itself. Students are no longer viewed as objects of learning, but rather as active subjects constructing knowledge through interactions with the world around them. In the context of elementary school mathematics learning, a contextual approach has great potential to bring mathematics closer to students' realities, build stronger conceptual understanding, and ultimately create a more inclusive and meaningful learning experience.

METHODOLOGY

This study uses a descriptive qualitative approach with a literature review method to analyze in-depth the comparison between conventional and contextual mathematics learning in elementary schools. A qualitative approach was chosen because it is suitable for exploring conceptual understanding, interpreting non-numerical data, and exploring the meaning and dynamics of learning approaches in the context of elementary education in a reflective and interpretive manner.

Literature studies can serve as a separate research method, especially if using a systematic or integrative approach (Synder, 2019). Literature studies are conducted by reviewing various scientific library sources such as accredited national and international journal articles, seminar proceedings, reference books, research reports, and curriculum documents published in the last 5 years (2019–2025). The inclusion criteria used in selecting the literature are: (1) direct relevance to conventional and contextual mathematics learning topics at the elementary school level; (2) using an empirical or theoretical analysis approach; and (3) published by credible institutions or through peer-review.

The research procedure was carried out through four stages: (1) literature identification, namely a systematic search using keywords such as "contextual teaching and learning," "conventional mathematics instruction," "elementary education," and "comparative learning approaches" in various databases (Google Scholar, ERIC, DOAJ, and Sinta); (2) selection and synthesis, namely sorting literature based on inclusion and exclusion criteria; (3) thematic analysis, namely grouping the contents of the literature into main themes such as teaching strategies, learning outcomes, student motivation, and implementation challenges; and (4) final interpretation and synthesis, namely compiling the findings in the form of a critical and integrative scientific narrative.

Data analysis was conducted using content analysis techniques, which involve interpreting the meaning of literary texts in depth and systematically. In this context, researchers identified argumentative patterns, empirical comparisons, and theoretical tendencies of each learning approach. The results of this analysis were used to construct a scientific argument that objectively compares the strengths, weaknesses, and implications of each approach in the context of elementary school mathematics learning.

The validity of the data in this literature study was strengthened through source triangulation, which involves comparing various publications from diverse perspectives, and peer debriefing, a process of reflectively discussing the findings and interpretations with colleagues or supervisors who have expertise in mathematics education and qualitative research methodology. Thus, the validity of the study results can be academically justified.

RESULTS AND DISCUSSION

1. Characteristics, Approaches, and Implementation of Conventional and Contextual Mathematics Learning in Elementary Schools

The conventional approach to mathematics learning is fundamentally rooted in behaviorist theory, which emphasizes stimulus-response. In this context, students are viewed as "tabula rasa" (a tabula rasa) that must be continuously filled with information and practice. The teacher is the sole source of information, thus placing full control over the learning process in their hands. This strategy places greater emphasis on drill and practice, with the hope that intensive repetition will improve students' retention and mechanical skills. In practice, the material is presented abstractly without always linking it to real-world situations familiar to students. This often makes it difficult for students to apply mathematical concepts in everyday life because they are not accustomed to connecting theory and practice. For example, students can memorize the formula for the area of a triangle, but do not understand how it is useful in real-world situations, such as calculating the area of a triangular plot (Lestari, 2019).

Meanwhile, the contextual approach is based on constructivist theory, particularly the ideas of Jean Piaget and Lev Vygotsky, which emphasize that students construct knowledge through active interaction with their environment. In contextual mathematics learning, students are encouraged to discover concepts themselves through problems relevant to their experiences (Khotimah & Asa, 2020). For example, when learning the concept of fractions, students are asked to divide a cake into several pieces as a concrete representation of dividing fractions. This activity not only facilitates students' understanding of the concept but also fosters curiosity and critical thinking skills.

One of the main principles of the contextual approach is problem-based learning, which allows students to engage in real-world problem-solving. This encourages students to work collaboratively in groups, develop mathematical communication skills, and consider various alternative solutions (Prihatinia & Zainil, 2020). In this context, the teacher is no longer the center of attention but rather a facilitator who facilitates students' exploration. Learning becomes more dynamic and interactive, and more relevant to their daily lives.

In its implementation, contextual learning requires careful planning and high creativity from teachers. Teachers must be able to identify contexts that are appropriate to the characteristics of the students and the surrounding environment. For example, in rural areas, the concept of volume can be taught using buckets or water tanks as learning media, while in urban areas, food containers or used bottles can be used. The use of concrete media and teaching aids is one of the keys to the success of this approach.

In terms of evaluation, conventional approaches often only measure cognitive aspects through written tests, which are less able to assess students' thinking processes. In contrast, contextual approaches use more comprehensive, authentic evaluations, encompassing affective, psychomotor, and cognitive assessments. For example, students can be assessed based on their engagement in group discussions, reports on exploration results, their ability to relate concepts to real-life situations, and personal reflections on the learning process. This allows teachers to understand students' learning development holistically.

Research also demonstrates the advantages of a contextual approach. Contextual learning can increase students' engagement with mathematics because they feel more engaged and understand the benefits of the material being studied (Sari et al., 2019). Students who learn using a contextual approach have higher problem-solving skills than

those who learn using a conventional approach (Hidayana & Lianingsih, 2025).

However, this doesn't mean that conventional approaches have no place in learning. In some situations, such as when introducing basic algorithms or rapid calculation skills, conventional approaches remain relevant and effective. Therefore, teachers should not pigeonhole approaches, but rather synthesize and select strategies that best suit the learning objectives, student characteristics, and the available learning context.

Considering the various aspects above, it can be concluded that a thorough understanding of the characteristics of each approach is crucial for teachers to create an effective, meaningful, and adaptive mathematics learning process tailored to the needs of elementary school students. The contextual approach offers a significant opportunity to transform mathematics from a daunting subject to one that is enjoyable and relevant to their daily lives.

2. Effectiveness of Conventional and Contextual Approaches on Learning Outcomes, Conceptual Understanding, and 21st Century Skills

The effectiveness of conventional and contextual approaches to learning has become a key focus in the development of 21st-century curricula and teaching strategies. The conventional approach is known as a teacher-centered learning method, characterized primarily by lectures, memorization, and repetitive exercises. This model emphasizes the one-way transmission of information from teacher to student and is often used to master procedural or algorithmic material, such as basic mathematical operations, speed reading techniques, or physics formulas. Although it tends to place students in a passive position, this approach has proven effective in instilling basic skills that require precision and repetition. For example, in mastering the concept of number operations, this approach allows students to quickly master calculation procedures through systematic practice.

However, the main limitation of the conventional approach lies in the minimal development of conceptual understanding and the lack of stimulation of critical and creative thinking skills. This is evidenced by a study by Hajar et al. (2024), which showed that students who are only taught using conventional models tend to experience difficulty in applying their knowledge to new contexts or in solving open-ended problems. In contrast, the contextual approach, which is born from constructivist thinking, assumes that students construct their own knowledge through direct experience, social interaction, and making meaning of the learning environment. This approach actively links learning materials to students' real-life contexts, such as the environment, parents' jobs, or current local problems. For example, in mathematics learning, the concept of measurement can be linked to calculating building materials for a simple house project in the students' neighborhood, so that students not only understand the formulas but are also able to apply them in real life.

An empirical study by Trisnawati & Hadi (2025) confirmed that when students engage in contextual problem-based learning, they demonstrate significant improvements in conceptual understanding and long-term retention. Students who learn in an environment that utilizes a contextual approach have higher intrinsic motivation, which encourages them to further explore the material being studied (Ayuningsih et al., 2025). In terms of 21st-century skills, this approach provides ample space for students to practice critical thinking, collaboration, communication, and creativity. For example, project-based learning (PjBL), a form of contextual approach, encourages students to work collaboratively to solve real-world problems within a specific timeframe. This not only trains students' cognitive aspects but also their social and emotional development.

However, it's important to note that the contextual approach presents its own challenges. Its implementation requires teachers' readiness to design meaningful learning, adequate resources, and flexible time allocation. In school contexts with limited facilities, teachers unfamiliar with active learning may struggle to design contextual activities. This is where conventional approaches still play a crucial role, particularly in building a foundation of early skills before students are led to more complex explorations.

Therefore, an effective learning approach is not a choice between conventional and contextual learning, but rather an integration of both in a flexible and adaptive model. Teachers need to be competent in adapting strategies to students' learning profiles, curriculum demands, and learning environment conditions. For example, teachers can begin learning with procedural explanations (conventional) and then reinforce them with applications in real-life case studies (contextual). This synergy will strengthen student learning outcomes holistically, enhance in-depth conceptual understanding, and equip students with relevant skills to face the social, economic, and technological challenges of the 21st century.

3. Theoretical and Practical Implications for the Development of Mathematics Learning Strategies in Elementary Schools

The theoretical and practical implications of the literature review on mathematics learning strategies in elementary schools are crucial in guiding the development of policies, curricula, and learning practices that address student needs. Practically, these findings can inform decision-making in formulating educational policies that promote more adaptive and contextual learning. For example, if various studies demonstrate that problem-based learning and contextual approaches can improve students' problem-solving skills and conceptual understanding (Astini & Purwati, 2020), then educational policy should systematically accommodate teacher training to master these approaches and integrate them into national and local curricula.

In the context of curriculum development, the results of the literature review encourage a paradigm shift from a centralized curriculum oriented toward achieving numerical targets to one that is flexible, responsive, and aligned with students' real-world needs. Curriculum adjustments that prioritize a thematic and experience-based approach have been shown to increase student motivation and engagement in the learning process (Febrianti & Mufidah, 2024). Therefore, the elementary mathematics curriculum should not only present abstract material but also link concepts such as measurement, fractions, and geometry to real-world activities in the student's environment, such as trading, farming, or simple financial management.

The development of teaching materials is also a crucial aspect that requires attention. Teachers and material developers need to design teaching aids and learning media that are multisensory, contextual, and participatory. For example, when teaching the concept of units of length, students can be asked to measure objects around the school using simple measuring tools. Hands-on experience manipulating real objects improves conceptual mathematical understanding in elementary school-aged children compared to lectures or memorization methods (Fajariyah, 2025).

Teacher training, as the frontline in curriculum implementation, is crucial. Teachers are not only required to master mathematics but also to develop pedagogical competencies that include the ability to design contextual learning, formulate questions appropriate to students' cognitive developmental levels, and create a classroom atmosphere that encourages exploration and reflection. Teachers also need to develop

socio-cultural literacy, namely sensitivity to students' local characteristics so that learning can be more grounded and relevant. For example, students in coastal areas can learn mathematics through calculating fish catches or trading transactions at fishing markets, while students in agricultural areas can learn through measuring land area or analyzing crop yields.

Theoretically, the findings from this literature review reinforce the constructivist approach to mathematics education. Constructivist theory, as proposed by Piaget and Vygotsky, assumes that knowledge cannot be passively transferred from teacher to student but must be actively constructed through interaction, exploration, and reflection. In this context, meaningful mathematics learning requires student involvement in formulating, testing, and interpreting their own mathematical ideas (Sarnoko et al., 2024). Therefore, teachers must create a learning environment that encourages students to ask questions, argue, and collaborate in problem-solving.

Furthermore, the Contextual Teaching and Learning (CTL) model is also an important foundation for developing learning strategies in elementary schools. This model emphasizes the importance of connecting subject matter to students' real-life contexts, making learning more meaningful. CTL can increase students' absorption of subject matter because new information is directly linked to previous experiences (Abdurashidovich, 2021). Through this approach, students understand not only the "what" and "how" but also the "why" of mathematical concepts.

Ultimately, all of these implications lead to one primary goal: to develop a mathematics learning strategy in elementary schools that not only produces academically proficient students but also develops logical, creative, and reflective thinking skills. Learning strategies built on a strong theoretical foundation and supported by contextual practice will create a more comprehensive, memorable, and impactful learning experience for students' daily lives. This aligns with the spirit of 21st-century education, which prioritizes conceptual understanding, critical thinking skills, and adaptability as core learning objectives.

CONCLUSION

A review of conventional and contextual approaches to mathematics learning in elementary schools demonstrates that both approaches have their own characteristics, advantages, and challenges. The conventional approach is effective in developing basic procedural skills through structured, intensive practice. However, its weakness lies in the lack of development of conceptual understanding and 21st-century skills. In contrast, the contextual approach emphasizes active student engagement through real-life experiences relevant to their lives. This fosters in-depth understanding, critical thinking skills, and higher learning motivation. Empirical studies show that the contextual approach has a positive impact on knowledge retention and problem-solving. However, its implementation requires creativity, teacher preparedness, and adequate resources. Therefore, the ideal approach is not to choose one over the other exclusively, but rather to integrate both adaptively. Teachers must be able to develop flexible strategies tailored to the context, student characteristics, and learning objectives. The theoretical and practical implications of this study reinforce the importance of constructivism as a foundation for meaningful mathematics teaching strategies. Concepts such as Contextual Teaching and Learning (CTL) have also proven effective in building connections between material and

students' realities. Ultimately, the combination of conventional and contextual approaches will create learning that is more effective, efficient, and in line with the demands of 21st-century education

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