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Learning Design: To Improve Mathematical Problem-Solving Skills Using a Contextual Approach

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Abstract
Mathematical problem-solving skills are essential for success in various fields, including science, technology, engineering, and mathematics (STEM). However, many students struggle with math and often lack the necessary skills to solve problems effectively. Traditional math education often lacks real-world context, which makes it difficult for students to engage with the material and develop problem-solving skills. To address this issue, the need for a contextual approach to learning design to improve mathematical problem-solving skills is inevitable. In the context of math education, this approach can be applied by providing learners with mathematical problems that are embedded in meaningful contexts, such as real-world scenarios or case studies. This approach draws from theories such as situated cognition and social constructivism, which emphasize the importance of considering the broader context in which problem-solving occurs. A literature review is used in this research method, and data analysis is done descriptively. By applying a contextual approach to mathematics learning design, students are expected to develop mathematical problem-solving skills that are important for success in various fields.

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Abstrak
Kemampuan pemecahan masalah matematika sangat penting untuk kesuksesan di berbagai bidang, termasuk sains, teknologi, teknik, dan matematika (STEM). Namun, banyak siswa yang kesulitan dengan matematika dan sering kali tidak memiliki keterampilan yang diperlukan untuk memecahkan masalah secara efektif. Pendidikan matematika tradisional sering kali tidak memiliki konteks dunia nyata, sehingga menyulitkan siswa untuk terlibat dengan materi dan mengembangkan keterampilan pemecahan masalah. Untuk mengatasi masalah ini, kebutuhan akan pendekatan kontekstual dalam desain pembelajaran untuk meningkatkan kemampuan pemecahan masalah matematika tidak dapat dihindari. Dalam konteks pendidikan matematika, pendekatan ini dapat diterapkan dengan memberikan siswa masalah matematika yang tertanam dalam konteks yang bermakna, seperti skenario dunia nyata atau studi kasus. Pendekatan ini berasal dari teori-teori seperti kognisi situasional dan konstruktivisme sosial, yang menekankan pentingnya mempertimbangkan konteks yang lebih luas dalam pemecahan masalah. Tinjauan literatur digunakan dalam metode penelitian ini, dan analisis data dilakukan secara deskriptif. Dengan menerapkan pendekatan kontekstual pada desain pembelajaran matematika, siswa diharapkan dapat mengembangkan kemampuan pemecahan masalah matematis yang penting untuk kesuksesan di berbagai bidang.

I. INTRODUCTION

In the 21st century, the demands of science and technology on Indonesian students are significant and multifaceted. As the world becomes increasingly interconnected and reliant on technological advancements, Indonesian students are expected to possess a range of skills and knowledge to meet the demands of this rapidly evolving landscape. The demands of science and technology require Indonesian students to develop critical thinking and problem-solving skills. They need to be able to analyze complex problems, think creatively, and develop innovative solutions (Ocy & Rahayu, 2023; Riyadi, Syarifah, & Nikmaturrohmah, 2021; Russo & Minas, 2020; Safrudiannur & Rott, 2019). These skills are crucial for addressing real-world challenges in various scientific domains.

Students are exposed to a curriculum that aims to develop their cognitive abilities, including problem-solving skills. According to the Programme for International Student Assessment (PISA) results, Indonesian students have below-average problem-solving abilities compared to other countries. In 2018, Indonesia ranked 60th out of 78 countries in problem-solving skills, with an average score of 434

(OECD, 2019). The Indonesian Ministry of Education and Culture has already specified the relevance of fundamental competency in problem-solving skills in the Merdeka curriculum. It is stated that one indicator of sufficient cognitive maturity to engage in learning activities such as literacy, numeracy, and a fundamental comprehension of how the world works is as follows; (1) creativity; (2) literacy abilities; and (2) mathematics to solve challenges (problem-solving skills) that arise in everyday life (Anggriani & Royanto, 2023). Problem-solving skills are unquestionably important in the mathematics learning process because they enable students to solve problems that used to be difficult to resolve.

Indonesian students face several challenges when it comes to mathematical problem-solving abilities. One of the primary difficulties in developing mathematical problem-solving abilities is the lack of real-world context in traditional math education (Nugraha & Basuki, 2021; Wulandari, Octaria, & Mulbasari, 2021). This can be due to a lack of exposure to critical thinking exercises and problem-solving activities early on in their education (Damayanti & Kartini, 2022). Many students struggle to see the practical applications of the mathematical concepts they are learning, which make it difficult for them to engage with the material and develop problem-solving skills (Nugraha & Basuki, 2021). Without a clear understanding of how math relates to real-life situations, students may find it challenging to apply their knowledge to solve practical problems.

A contextual approach emphasizes the importance of considering the broader context in which problem-solving occurs, including the social, cultural, and environmental factors that may impact an individual's ability to solve problems effectively (Apriadi, 2021; Clarke & Roche, 2018; Hobri, Septiawati, & Prihandoko, 2018; Lestari, Ahmadi, & Rochmad, 2021; Navianto, 2023; Reyes, Insorio, Ingreso, Hilario, & Gutierrez, 2019). This approach acknowledges that problem-solving is not a purely cognitive process but is also influenced by external factors. When applied to mathematics education, a contextual approach seeks to enhance students' problem-solving abilities by providing learning experiences that are situated within meaningful and authentic contexts.

The contextual approach to problem solving in education draws from theories such as situated cognition and social constructivism (Alibali, Brown, & Menendez, 2019; Damianus Dao Samo, Darhim, & Kartasasmita, 2018). Situated cognition posits that learning and problem solving are inherently tied to the context in which they occur (Alibali et al., 2019). In other words, students do not solve problems in a vacuum; rather, their problem-solving abilities are shaped by the specific situations and environments in which they find themselves. Social constructivism further emphasizes the role of social interactions and cultural influences on learning and problem solving (Damianus Dao Samo et al., 2018). According to this theory, knowledge is co-constructed through interactions with others, and problem-solving abilities are developed within social and cultural contexts.

This area of research is crucial as it seeks to explore how the learning design, including the context in which problems are presented, impacts students' problem-solving skills. The urgency of this research lies in the need to enhance educational practices and develop effective strategies that can better support students in developing problem-solving abilities.

II. METHOD

In this study, a literature review was used as the research methodology. The literature review is the strategy used in this research to obtain information and gathering data. Journal articles on the topic of discussion are used as a source of information. The article review focuses on reviewing recent journal publications regarding mathematical problem solving abilities and contextual approaches. The review relies on articles published within the last five years. Prior to making conclusions, research findings in data analysis are described using the method known as descriptive analysis.

III. RESULT AND DISCUSSION

A. Mathematical Problem-Solving Skills

Based on Nakakoji & Wilson's (2020) research, mathematical problem-solving is a cognitive process that involves the use of mental processes such as attention, perception, memory, and reasoning to solve mathematical problems. This definition emphasizes the importance of understanding the cognitive processes involved in mathematical problem-solving, rather than simply focusing on the end result. Understanding the cognitive processes involved in mathematical problem-solving is particularly valuable in identifying and addressing learning difficulties. By examining how students process information, apply reasoning skills, and manipulate mathematical concepts during problem-solving tasks, educators can pinpoint specific areas where learners may struggle. A nuanced understanding of cognitive processes sheds light on the underlying causes of learning difficulties in mathematics. Whether stemming from working memory limitations, attention deficits, or conceptual misunderstandings, these insights enable educators to implement tailored interventions that address the root issues affecting students' mathematical problem-solving abilities.

Another definition from Verschaffel, Schukajlow, Star, & Van Dooren (2020), mathematical problem-solving skills as the ability to apply mathematical knowledge to solve problems effectively. This definition highlights the importance of developing skills in mathematical problem-solving, such as the ability to identify relevant mathematical concepts, select appropriate methods, and apply them to solve problems. Identifying relevant mathematical concepts involves understanding the problem at hand and recognizing which mathematical principles and theories are applicable (Arafani, Herlina, & Zanthy, 2019). For instance, when faced with a real-world problem involving quantities and their relationships, one must be able to identify the relevant mathematical concepts that can be used to model and solve the problem. Once the relevant mathematical concepts have been identified, the next step is to select the appropriate methods for solving the problem. This involves choosing the right mathematical tools, techniques, and formulas that align with the identified concepts (Szabo, Körtesi, Guncaga, Szabo, & Neag, 2020).

For example, if the problem involves analyzing patterns and predicting outcomes, one might choose to apply statistical methods or probability theory. After identifying the relevant mathematical concepts and selecting the appropriate methods, the final step is to apply these methods to solve the problem at hand. It involves translating real-world problems into mathematical models and equations, applying the chosen methods accurately, and interpreting the results in the context of the original problem (Nursyahidah, Saputro, & Rubowo, 2018). Through this process, individuals can effectively use mathematics to address complex issues across various domains. This is in line with Isharyadi (2018) who stated, problem-solving abilities are essential skills that enable individuals to analyze complex situations, identify challenges, and develop effective strategies to address them. When devising a plan, problem-solving abilities play a crucial role in guiding individuals through the process of understanding the problem, generating potential solutions, evaluating these solutions, and implementing the most suitable course of action.

Gurat (2018) stated that mathematical problem-solving as a disciplinary practice that involves the use of mathematical knowledge, skills, and habits of mind to solve problems. This definition emphasizes the importance of understanding the context and conventions of mathematical problem-solving, as well as the need to develop a deep understanding of mathematical concepts and their applications. It encompasses a wide range of activities, from solving routine problems to tackling complex, open-ended mathematical challenges. This process requires students to engage in critical thinking, reasoning, and creativity to develop strategies for approaching and solving problems. Based on Arnellis, Fauzan, Arnawa, & Yerizon's (2021) study, this definition thus makes sense, which indicate mathematical problem-solving is a metacognitive process that involves the use of higher-order thinking skills such as planning, monitoring, and evaluating one's own problem-solving strategies. This definition highlights the importance of developing metacognitive skills in mathematical problem-solving, such as the ability to reflect on one's own thinking and adjust one's strategies as needed.

According to Riyadi et al. (2021), mathematical problem-solving as a collaborative process that involves the use of communication, collaboration, and technology to solve mathematical problems. This definition emphasizes the importance of collaboration and communication in mathematical problem-solving, as well as the potential benefits of using technology to facilitate collaboration and problem-solving. When individuals collaborate to solve problems in mathematics, they can take advantage of each other's unique viewpoints, abilities, and expertise to provide more thorough and creative answers. This cooperative method develops critical thinking abilities and a deeper comprehension of mathematical ideas in addition to improving problem-solving abilities. Technology plays a significant role in modern mathematical problem-solving (Lin, Yu, Hsiao, Chang, & Chien, 2020; Setiyani, Fitriyani, & Sagita, 2020). For instance, technological tools such as graphing calculators, computer algebra systems, and programming environments empower individuals to experiment with mathematical models and algorithms, thereby expanding the scope of problems they can tackle collaboratively. Additionally, technology offers access to vast repositories of mathematical information, interactive simulations, computational tools, and visualization software that can aid in understanding complex mathematical concepts and exploring problem-solving strategies (Barak & Assal, 2018).

Mathematical problem solving abilities pay close attention to evaluating solutions (Gurat, 2018). When evaluating solutions, it is important to assess the problem solving abilities of the solution provider to ensure that they can identify and address the root causes of the problem, and provide a feasible and effective solution. Furthermore, mathematical problem solving abilities also pay attention to reflection on the problem solving process (Setiawan & Rizki, 2018). Reflecting on the process of problem-solving abilities entails understanding the strategies, skills, and mindset involved in approaching and resolving problems.

In conclusion, these definitions of mathematical problem-solving abilities highlight the importance of developing a range of skills and knowledge in mathematical problem-solving, including cognitive processes, skills, disciplinary practices, metacognitive strategies, and collaborative processes. By understanding these different definitions and their underlying principles, educators and learners can better support the development of mathematical problem-solving abilities. Based on the definition's above, mathematical problem-solving involves several key characteristics that distinguish it as a disciplinary practice: (1) Understanding the Problem: The first step in solving a mathematical problem is to thoroughly understand the given problem statement, identify the knowns and unknowns, and clarify any ambiguities. (2) Devising a Plan: Developing a strategic plan or approach for solving the problem is essential. This may involve breaking down the problem into smaller, more manageable parts, considering similar problems as models, or using visual representations. (3) Implementing the Plan: Once a plan is formulated, individuals implement their chosen strategies while maintaining flexibility to adjust their approach if necessary. (4) Evaluating Solutions: After obtaining a potential solution, it is crucial to evaluate its validity and reasonableness. This may involve checking calculations, verifying results, or considering alternative methods. (5) Reflecting on the Process: Reflecting on the problem-solving process allows individuals to assess their strategies, identify areas for improvement, and gain insights for future problem-solving endeavors.

B. Contextual Approach In Mathematics Learning

The Contextual Approach in Mathematics Learning is a teaching methodology that emphasizes the importance of context in understanding mathematical concepts (Alibali et al., 2019; Ariyanto, Rahmawati, & Haris, 2020; Lestari et al., 2021; Navianto, 2023; Reyes et al., 2019). The approach is based on the idea that mathematical knowledge is not just a set of abstract rules and formulas, but rather a collection of tools that can be applied to real-world situations. According to Reyes et al. (2019), the authors argue that the contextual approach is defined as a framework that considers the influence of environmental and situational factors on individual behavior and experiences. It emphasizes the interconnectedness between individuals and their surroundings, highlighting the impact of context on cognition and behavior. This definition is in line with Clarke & Roche's (2018) research, which states, the contextual approach as a pedagogical strategy that integrates real-world contexts into learning experiences. It emphasizes the application of knowledge and skills in authentic settings, aiming to enhance students' understanding and retention of information by connecting it to relevant real-life situations.

Contextualization occurs when instructional materials and approaches are linked to the student's experiences and environment. Using local objects and knowledge in the classroom allows students to completely grasp mathematical ideas (Arafani et al., 2019; Isharyadi, 2018; Sari, Arini, & Amaliyah, 2023; Sugandi & Bernard, 2018). It is possible to infer that implementing a contextual approach in mathematics learning involves incorporating real-world situations and applications into the teaching and learning process. Contextual approach aims to help students understand the relevance of mathematical concepts and develop problem-solving skills that can be applied in practical scenarios (Navianto, 2023). Several key indicators must be present to effectively implement a contextual approach in mathematics learning:

1. Real-World Connections (Reyes et al., 2019): One of the essential indicators for implementing a contextual approach in mathematics learning is the incorporation of real-world connections. This involves using examples, problems, and activities that relate to everyday experiences, professions, or societal issues. By demonstrating how mathematical concepts are used in real-life situations, students can develop a deeper understanding of the relevance and applicability of mathematics.
2. Interdisciplinary Integration (Nakakoji & Wilson, 2020; Yeni, Syarifuddin, & Ahmad, 2019): A contextual approach often requires the integration of multiple mathematical concepts to solve a single problem. This interdisciplinary nature encourages students to draw connections between different areas of mathematics and apply various techniques to address complex real-world issues. For instance, a problem related to calculating the trajectory of a projectile may involve elements of geometry, algebra, and physics, prompting students to utilize their knowledge across these domains.
3. Project-Based Learning (Chan, Clarke, & Cao, 2018; Clarke & Roche, 2018): Students engage in projects that require them to apply mathematical knowledge to address authentic problems. This could involve designing experiments, analyzing data sets, or creating models relevant to specific contexts.
4. Problem-Based Learning (Hendriana, Johanto, & Sumarmo, 2018; Novita, Aminatun, & Daryono, 2022; Zakiyah, Purnomo, & Sugiyanti, 2019): Implementing a contextual approach often involves utilizing problem-based learning strategies. This indicator focuses on presenting students with authentic, complex problems that require the application of mathematical concepts to find solutions. By engaging in problem-solving activities, students can develop critical thinking skills and gain a deeper insight into the practical use of mathematics.
5. Authentic Assessment (Priemer et al., 2020; Yuwandra & Arnawa, 2020): An important indicator for implementing a contextual approach is the use of authentic assessment methods. This involves evaluating students' understanding and proficiency in mathematics through performance tasks, projects, or presentations that mirror real-world challenges. Authentic assessment allows educators to gauge students' ability to apply mathematical knowledge in contextually relevant scenarios.
6. Technology Integration (Astri, Wiarta, & Wulandari, 2022; Widyaputri & Agustika, 2021): Incorporating technology as a tool for contextual learning is another key indicator. Utilizing digital resources, simulations, and interactive applications can enhance students' engagement and provide opportunities to explore mathematical concepts within authentic contexts.
7. Cultural Relevance (Nur, Waluya, Rochmad, & Wardono, 2020; Nursyahidah et al., 2018; Damianus D Samo & Kartasasmita, 2017): Recognizing cultural diversity and incorporating culturally relevant examples and perspectives into mathematics instruction is also crucial when implementing a contextual approach. By acknowledging the diverse backgrounds and experiences of students, educators can create a more inclusive learning environment that resonates with learners from various cultural backgrounds.
8. Collaborative Learning Environments (Buchori, 2019; Sugandi & Bernard, 2018; Sunarto, Laa, Mahtuum, Siagian, & Afrilianto, 2021): Encouraging collaborative learning environments where students work together to solve real-world

problems is an important indicator for implementing a contextual approach in mathematics education. Collaborative activities promote peer interaction, communication skills, and teamwork while addressing authentic mathematical challenges.

In conclusion, implementing a contextual approach in mathematics learning requires the presence of key indicators such as real-world connections, interdisciplinary integration, project or problem-based learning, authentic assessment, technology integration, cultural relevance, and collaborative learning environments.

C. The Relevance of Contextual Approaches and Problem Solving Abilities

The contextual approach in mathematical problem-solving refers to the process of understanding and solving mathematical problems within real-world contexts (Szabo et al., 2020). This approach is highly relevant as it helps students develop a deeper understanding of mathematical concepts by connecting them to practical, everyday situations. By presenting mathematical problems in context, students can see the relevance and applicability of mathematical concepts in various fields such as science, engineering, economics, and social sciences (Lin et al., 2020; Priemer et al., 2020). This approach also fosters critical thinking skills as students are required to analyze and interpret the given context before applying mathematical techniques to solve the problem (Lestari et al., 2021).

One of the key advantages of the contextual approach is its ability to enhance students' problem-solving skills (Arafani et al., 2019; Buchori, 2019; Isharyadi, 2018; Suhandri & Sari, 2019; Zakiah, Sunaryo, & Amam, 2019). When mathematical problems are presented in real-world contexts, students are encouraged to think critically and creatively about how to apply their mathematical knowledge to solve practical problems (Gurat, 2018). This not only strengthens their mathematical abilities but also equips them with valuable problem-solving skills that are essential in both academic and professional settings.

Furthermore, the contextual approach promotes interdisciplinary learning by demonstrating the interconnectedness of mathematics with other subjects (Barak & Assal, 2018; Yeni et al., 2019). Students can see how mathematical concepts are utilized in various fields, leading to a more holistic understanding of the subject. This interdisciplinary approach is particularly relevant in today's educational landscape, where there is a growing emphasis on integrating different disciplines to provide a comprehensive education.

In addition, the contextual approach fosters a deeper appreciation for the relevance of mathematics in everyday life (Nur et al., 2020; Nursyahidah et al., 2018). By presenting mathematical problems in familiar contexts, students can recognize the practical applications of mathematics and understand its significance in addressing real-world challenges (Szabo et al., 2020). This can lead to increased motivation and engagement with the subject as students perceive its direct relevance to their lives. oreover, the contextual approach aligns with modern educational goals that emphasize the development of transferable skills (Alibali et al., 2019; Damianus D Samo & Kartasasmita, 2017). By engaging with mathematical problems in context, students not only acquire mathematical knowledge but also develop skills such as critical thinking, analytical reasoning, and communication – all of which are highly valued in today's workforce (Arnellis et al., 2021).

It can be concluded, the contextual approach plays a crucial role in developing students' problem-solving skills. By presenting mathematical problems within meaningful contexts, students are encouraged to think critically and creatively about how to apply their mathematical knowledge to solve real-world challenges. This approach fosters the development of analytical thinking, logical reasoning, and decision-making skills, which are essential not only in mathematics but also in various aspects of life.

D. Application of Mathematical Problem-Solving Skill Steps Using A Contextual Approach

1. Solving Math Problems with Real-World Connections

When faced with a math problem that has real-world connections, it's important to approach it systematically in order to fully comprehend and solve it. Here are the steps that should be taken to understand such problems.

a) Read the Problem Carefully (Damianus D Samo & Kartasasmita, 2017): The first step is to carefully read the problem and identify the real-world context or scenario being described. Understanding the context is crucial as it provides the necessary information for formulating a mathematical model.
b) Identify Key Information (Widyastuti & Airlanda, 2021): Next, identify the key pieces of information provided in the problem. This may include numerical data, units of measurement, and any other relevant details that are essential for solving the problem.
c) Define Variables (Zakiah et al., 2019): Once the key information has been identified, define the variables that will be used to represent the unknown quantities in the problem. Assigning variables helps in setting up equations and formulating mathematical relationships based on the real-world scenario.
d) Formulate Equations or Inequalities (Damayanti & Kartini, 2022): Based on the real-world context and the identified variables, formulate equations or inequalities that represent the relationships between the quantities involved. This step involves translating the real-world situation into mathematical expressions.
e) Solve the Mathematical Model (Suhandri & Sari, 2019): With the equations or inequalities in place, proceed to solve the mathematical model using appropriate mathematical techniques such as algebraic manipulation, trigonometric functions, calculus, or other relevant methods depending on the nature of the problem.
f) Interpret the Solution (Alibali et al., 2019; Nur et al., 2020): Once a solution is obtained, it's important to interpret it in the context of the real-world scenario. This involves understanding what the solution represents in practical terms and whether it aligns with the initial problem statement.
g) Verify and Reflect (Damianus Dao Samo et al., 2018): Finally, verify whether the solution makes sense within the given real-world context. Reflect on whether the obtained solution addresses the original question posed and whether it is a reasonable outcome based on common sense and logic.

By following these steps, students can effectively approach math problems with real-world connections, ensuring a thorough understanding of both the mathematical concepts involved and their practical applications.

2. Solving Math Problems with Interdisciplinary Integration

When faced with a math problem that has interdisciplinary integration, it's important to approach it systematically in order to fully comprehend and solve it. Here are the steps that should be taken to understand such problems.

a) Understanding the Problem (Brinus, Makur, & Nendi, 2019): When a student is given a math problem with interdisciplinary integration, it is essential to first understand the problem thoroughly. This involves carefully reading and analyzing the problem statement to identify the mathematical concepts involved and any other disciplines that may be integrated into the problem. Understanding the context of the problem and how different disciplines intersect is crucial in approaching interdisciplinary math problems.
b) Identifying Relevant Concepts (Reyes et al., 2019): After understanding the problem, the next step is to identify the relevant mathematical concepts and principles that are applicable. This may involve recognizing specific mathematical formulas, theorems, or techniques that can be used to solve the problem. Additionally, in interdisciplinary integration, it is important to identify any concepts from other disciplines that are relevant to solving the problem.
c) Formulating a Plan (Arafani et al., 2019): Once the relevant concepts have been identified, it is important to formulate a plan for solving the problem. This plan should outline the steps that will be taken to integrate the different disciplines and apply appropriate mathematical methods. It

may involve breaking down the problem into smaller, more manageable parts and determining how each part will be addressed using interdisciplinary approaches.

d) Implementing the Solution (Zakiah et al., 2019): With a clear plan in place, the next step is to implement the solution by applying mathematical techniques and integrating concepts from other disciplines as necessary. This may involve performing calculations, conducting analyses, or using specific strategies to address each component of the problem in an interdisciplinary manner.

e) Checking for Accuracy (Dwi Jayanti, Bambang Irawan, & Irawati, 2018): After solving the problem, it is crucial to check for accuracy and ensure that all aspects of the interdisciplinary integration have been appropriately addressed. This involves reviewing the solution, verifying calculations, and confirming that both mathematical and interdisciplinary components have been correctly applied.

f) Communicating the Solution (Damianus Dao Samo et al., 2018): It is important for the student to effectively communicate their solution, including how they integrated different disciplines to solve the math problem. This may involve providing explanations, justifications, and interpretations of the results in a clear and coherent manner.

Solving mathematics problems with interdisciplinary integration involves applying multiple mathematical concepts to solve a single problem. This approach emphasizes the interconnectedness of different disciplines and the use of mathematics as a universal language to address complex issues. By integrating mathematics with multiple concepts, students can develop a deeper understanding of both the mathematical principles and the real-world applications, fostering critical thinking and problem-solving skills.

E. Learning Design using Contextual Approach to Improve Students' Mathematical Problem Solving Skills

Based on the mathematical problem solving skills steps and the definition of the contextual approach that has been described, a learning design is created which can be seen in Table 1. Learning design with a contextual approach is an effective method for learning mathematics as it emphasizes real-world problem-solving and application of mathematical concepts in various contexts (Alibali et al., 2019; Chong, Shahrill, & Li, 2019). This approach engages students in active learning, critical thinking, and problem-solving skills, which are essential for understanding and mastering mathematical concepts. The steps for learning mathematics using problem-based learning with a contextual approach involve several key features.

Table 1. Problem-Based Learning with Contextual Approach

Key Features	Teacher Activities	Student Activities
Contextualization: The learning activities and assessments are designed to be relevant to the learners' current situation, context, and goals. This means that the learning content and tasks are tailored to the learners' unique needs and situations	**Presentation Contextual Problems**: The teacher presents the contextual problem. Presentation of the contextual problem can be displayed in pictures, stories, videos and more with the various problems that enable their activities to think critically, analytically and creatively	**Identifying Real-World Problems**: The first step in this approach is to identify real-world problems that can be used as the basis for learning mathematical concepts. These problems should be relevant to students' lives and should require the application of mathematical principles to find solutions. For example, problems related to budgeting, statistics in sports, or geometric concepts in architecture can be used to engage students in meaningful mathematical learning
Active engagement: The learning design encourages active engagement and participation from the learners. This approach recognizes that learners need to be actively engaged in the learning	**Asking Critical and Analytical Question**: The teacher asking analytical and critical questions about the paradox or dilemma or possibilities,	**Formulating Mathematical Questions**: Once the real-world problems are identified, the next step is to formulate mathematical questions that are related to these problems. These questions should

process to acquire new knowledge and skills.	asking students to generate their own questions about the issues presented, starting with the question of the lower order thinking that leads to a higher-order thinking questions.	require students to apply mathematical concepts such as algebra, geometry, statistics, or calculus to analyze and solve the given problems. By formulating these questions, students can see the practical relevance of mathematics in addressing real-life challenges
Learner-centered: The learning design process is centered around the needs and preferences of the learners, rather than the instructor or the curriculum. This approach takes into account the learners' prior knowledge, skills, interests, and motivation to create a personalized learning experience.	**Groups Investigation**: The teacher asks the students to join the group to discuss the completion of the group task.	**Research and Investigation**: Students engage in research and investigation to gather relevant data, information, and resources that are necessary for solving the identified real-world problems. This step involves utilizing various sources such as textbooks, online databases, scientific articles, and expert interviews to gather information that will aid in the mathematical analysis and solution of the problems.
Flexibility: The learning design is flexible and adaptable to different learning contexts and environments. This approach recognizes that learners may have different learning styles, abilities, and preferences, and that the learning environment may vary depending on the context.	**Collaborative Learning**: In this step, students work together in groups to solve the identified problems and answer the formulated mathematical questions. The teachers encourage their students to think analytically, ie thinking about strategies and concepts that students use in solving their problems. The teacher acts as a facilitator who provides support (scaffolding).	**Application of Mathematical Concepts**: Students apply their knowledge of mathematical concepts to analyze the collected data, formulate strategies, and develop solutions to the real-world problems. They use mathematical models, equations, graphs, and calculations to address the specific challenges presented by the identified problems.
Feedback and reflection: The learning design includes ongoing feedback and reflection to help learners understand their progress and adjust their learning strategies accordingly. This approach recognizes that feedback and reflection are essential to the learning process.	**Presentation and Discussion**: The teacher ask some students who are the representatives of several groups to present their solutions to the class, and also the teachers respond and provide an explanation as the conclusion of the students' problem-solving.	**Presentation of Findings**: The students presenting their findings and solutions to the class or a wider audience. This presentation may take various forms such as oral presentations, written reports, multimedia presentations, or demonstrations. Through this process, students communicate their mathematical reasoning, problem-solving strategies, and conclusions derived from applying mathematics in a real-world context.
	Reflection: The teacher guides the students to make a conclusion or a brief summary of the concepts or ideas contained in the proposed problems.	**Reflection**: After working on solving the real-world problems using mathematical concepts, students engage in reflection and evaluation of their solutions. They critically assess their approaches, discuss the strengths and limitations of their solutions, and reflect on the applicability of mathematics in addressing the given context. This reflective process enhances metacognitive skills and promotes deeper understanding of mathematical concepts.

It is intended that students would get a deeper comprehension of mathematical ideas while refining their critical thinking, problem-solving, collaborative, research, and communication skills by following the processes in the learning design with a contextual approach.

F. DISCUSSION

One of the key benefits of implementing learning design with a contextual approach is its positive impact on students' conceptual understanding of mathematical principles (Wang & Hofkens, 2020). When students are presented with real-world problems that require mathematical solutions, they are compelled to apply their knowledge in practical scenarios. This application of concepts in context fosters a deeper understanding of the underlying principles, as students can see how mathematics is used to solve authentic problems (Alibali et al., 2019). As a result, students are more likely to develop a robust conceptual foundation in mathematics, which forms the basis for effective problem-solving abilities.

Integrating real-world contexts into the learning design can also lead to enhanced student engagement and motivation (Barak & Assal, 2018; Hanifah & Nuraeni, 2020). Traditional abstract mathematical problems may sometimes fail to capture students' interest or demonstrate the practical relevance of the concepts being taught. However, when mathematics is presented in context, students are more likely to be engaged as they recognize the value and applicability of what they are learning. This increased engagement can lead to higher levels of motivation and perseverance when tackling mathematical problems, ultimately contributing to improved problem-solving abilities (Siregar, Holila, & Nasution, 2020).

A contextual approach to learning design encourages the development of critical thinking skills in students (Szabo et al., 2020). Real-world problems often require creative and analytical thinking to arrive at solutions. By engaging with contextualized mathematical challenges, students have the opportunity to hone their critical thinking abilities as they navigate through complex scenarios that demand logical reasoning and problem-solving strategies. Over time, this can lead to the cultivation of advanced problem-solving skills that are transferable across various domains.

A contextual approach to learning design for improving mathematical problem-solving skills found that this approach has several benefits. First, it promotes deeper learning by encouraging learners to engage with the material in a more meaningful way (Arafani et al., 2019). Second, it helps learners to develop a better understanding of the context in which the math concepts are applied (Chong et al., 2019). Third, it enhances learners' ability to transfer their knowledge to new situations (Nakakoji & Wilson, 2020).

Furthermore, implementing learning design with a contextual approach enables students to apply mathematical concepts in diverse and authentic settings (Nur et al., 2020). This application-oriented learning fosters a deeper level of comprehension as students grapple with real-world problems that necessitate the use of mathematical tools and techniques. Through this process, students gain practical experience in utilizing mathematics to address genuine challenges, thereby refining their problem-solving capabilities within different contexts (Suantiani & Wiarta, 2022).

IV. CONCLUSION AND SUGGESTION

A. Conclusion

A contextual approach to learning design for students' mathematical problem-solving abilities is expected to yield improved engagement, enhanced understanding, transferable skills, critical thinking development, and practical application of mathematics. By incorporating real-world contexts into the learning process and employing specific design strategies, educators can effectively support students in developing robust mathematical problem-solving skills that extend beyond the classroom. Implementing learning design with a contextual approach has the potential to significantly enhance students' mathematical problem-solving abilities. By grounding mathematical concepts in real-world contexts, this approach promotes deeper conceptual understanding, heightened engagement and motivation, the development of critical thinking skills, practical application of mathematical knowledge, and an appreciation for interdisciplinary connections. These combined effects contribute to the overall improvement of students' problem-solving capabilities within the domain of mathematics.

Influencing students' mathematical problem-solving abilities through learning design with a contextual approach is a complex and multifaceted process. This approach involves creating an environment where students can apply mathematical concepts to real-world situations, thereby enhancing their problem-solving skills. By integrating contextual learning into the design of mathematics instruction, educators can help students develop a deeper understanding of mathematical concepts and their practical applications. This comprehensive approach to learning design has the potential to significantly impact students' mathematical problem-solving abilities. This comprehensive approach not only enhances students' problem-solving skills but also fosters a positive attitude towards mathematics by demonstrating its practical significance in various aspects of life.

B. Suggestion

The discussion regarding this research is still very limited and requires a lot of input. The suggestion for future authors is to study it more deeply and comprehensively about Learning Design: To Improve Mathematical Problem-Solving Skills Using a Contextual Approach.

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