

Mathematics Learning Strategies in Developing Numeracy Competence in Primary School Students

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Abstract. The low level of numeracy competence among primary school students, particularly in understanding and applying mathematical concepts in everyday life, poses a challenge to improving the quality of basic education. Conventional and abstract learning methods make it difficult for students to relate mathematical concepts to real-life contexts, resulting in low motivation and poor learning outcomes. This study aims to formulate and analyse effective mathematics learning strategies to improve the numeracy skills of students at Budibakti State Elementary School in Cianjur Regency. The study uses a qualitative approach with a case study design. Data were obtained through observation, in-depth interviews, and documentation, and analysed using triangulation and content analysis. The results show that the application of innovative and contextual learning strategies such as problem-based learning, differentiated learning, the use of interactive media, and integrated formative assessment of numeracy can increase students' activity, motivation, and ability to connect mathematical concepts with real-life situations. The conclusion of the study confirms that innovative, interactive, and applicable mathematics learning strategies have a positive effect on improving students' numeracy competencies and support the implementation of the Merdeka Belajar (Freedom of Learning) policy and Minimum Competency Assessment (AKM).

Keywords: learning strategies, mathematics, numeracy skills, primary school, case studies.

1 Introduction

Numeracy skills are an important indicator of the quality of basic education because they play a role in developing logical, analytical and problem-solving skills [1]. Numeracy is an essential basic skill, not only useful for solving mathematical problems, but also playing an important role in everyday activities [2]. Muspita (2024) revealing a similar sentiment that improving numeracy literacy is a fundamental requirement in education because it serves as an important indicator in assessing the effectiveness of the learning process [3]. On the other hand, numeracy skills are related to student learning achievement [4].

However, many primary school students still have difficulty understanding and applying mathematical concepts in their daily lives [3]. Based on survey results, the low level of numeracy achievement among students in Indonesia is closely related to the use of learning strategies that are not contextual and fail to stimulate students' interest in learning [5]. Abstract mathematics learning that is oriented towards memorising formulas often makes it difficult for students to relate the material to real-life contexts, resulting in low motivation and learning outcomes [6]. This condition highlights the need for learning strategies that are able to develop meaningful numeracy competencies from primary school level onwards.

At Budibakti State Elementary School in Cianjur Regency, the mathematics learning process is still dominated by conventional methods in the form of lectures and exercises. One of the main factors causing low numeracy skills among students is the application of learning methods that lack context [7], thus failing to optimally foster students' interest and motivation to learn [6]. Students become passive, only receiving explanations without the opportunity for exploration or discussion [8]. As a result, many students find it difficult to apply mathematical concepts to solve contextual problems [9]. This has an impact on the low achievement of numeracy competencies as shown in the Minimum Competency Assessment (AKM) results and teacher assessments at school.

Various studies show that innovative learning strategies can improve students' numeracy skills. Ayu et al. (2021) found that a contextual approach can improve students' logical thinking skills in mathematics [10]. Kanah and Mardiani (2022) explain that problem-based strategies are effective in developing the ability to express ideas in mathematical form [11]. Mardiani et al. (2022) emphasise the importance of experience-based learning to improve numeracy literacy [12]. Salma et al. (2022) also stated that rational and critical thinking exercises need to be integrated into mathematics learning activities [13]. Krisdiana (2024) highlighted that the dominance of conventional methods is the cause of low motivation and mathematics learning outcomes in primary schools [14].

Mathematics learning strategies are conceptual designs that include approaches, strategies, methods, and technique [15], which teachers use to create effective and efficient learning experiences to achieve learning objectives. Learning strategies serve as tactics planned by teachers to manage the learning process so that interactions with students run optimally [16] and to foster students' interest and creativity in learning mathematics. A learning approach is a general perspective or policy used by teachers and students in achieving learning objectives, while a method is a concrete step to implement the strategy in teaching and learning activities [17].

Numeracy competence is a person's ability to access, use, interpret, and communicate mathematical information and ideas in solving real-life problems [18]. This competency is not only related to the ability to calculate, but also includes the ability to think critically, analytically, and reason using mathematical concepts to make the right decisions [19]. In the context of primary education, numeracy competency is the basis for the development of higher order thinking skills, which are implemented through experience-based and reflective learning.

Previous studies have shown that innovative learning models contribute significantly to improving students' numeracy skills. Agustika (2021) emphasises that teachers need to consider interactive learning models to create an active and meaningful learning environment [20]. Anggraini (2020) found that numeracy skills are not only determined by conceptual knowledge but also by students' ability to apply mathematical logic in everyday contexts [19]. Lestari and Putri (2020) assert that contextual learning can improve students' ability to understand and apply mathematical concepts [21]. Wulandari et al. (2020) showed that numeracy skills are closely related to mastery of numbers and basic mathematical operations [22]. The contextual learning approach has been proven to improve students' ability to understand and apply mathematical concepts to various problems that occur in everyday life. Meanwhile, Harianti (2017) emphasises that mathematics learning must foster conceptual understanding and the ability to relate symbols to mathematical meanings so that students can solve problems correctly [23][24].

The theoretical framework of this study is based on constructivist learning theory, which emphasises that knowledge is actively constructed by learners through learning experiences. In this context, mathematics learning strategies serve as a bridge between abstract concepts and students' concrete experiences. The principle of student-centred learning is applied so that students become active subjects in the learning process. A well-structured learning model involves contextual approaches, interactive methods, and numeracy-based evaluation to measure students' conceptual understanding [25].

In addition, the Higher Order Thinking Skills (HOTS) theory is used as a reference in developing reasoning and critical thinking skills through problem-solving activities. In this case, teachers act as facilitators who guide students in connecting old knowledge with new experiences [26]. Thus, the mathematics learning strategies developed in this study focus not only on cognitive outcomes but also on students' thinking processes, active participation, and reflective abilities.

The concept of mathematics learning strategies is relevant to the focus of this study because it provides a conceptual basis for designing effective learning to develop students' numeracy competencies. Numeracy theory provides direction for researchers in assessing the success of context-based and problem-solving learning. Previous research results reinforce the urgency of innovation in mathematics learning strategies in primary schools, especially to improve low numeracy skills.

By integrating constructivist theory, contextual approaches, and HOTS development, this study seeks to formulate effective, interactive, and applicable mathematics learning strategies. This model is expected to be a concrete solution for improving the numeracy competencies of students at Budibakti Public Elementary School in Cianjur Regency, while also supporting the national policies of Merdeka Belajar (Freedom of Learning) and Asesmen Kompetensi Minimum (AKM) (Minimum Competency Assessment).

Although many studies have discussed mathematics learning strategies [11], [12], most have not produced learning models that are contextually integrated with the development of numeracy competencies at the primary school level. There have not been many studies that specifically examine the application of learning strategies designed based on the characteristics of primary school students in Cianjur. Furthermore,

previous studies tend to highlight the effectiveness of certain methods without developing a holistic model that includes integrated approaches, media, and evaluation systems. Therefore, this study attempts to fill this gap by developing applicable and contextual mathematics learning strategies.

What are effective mathematics learning strategies for developing students' numeracy competencies at Budibakti State Primary School in Cianjur Regency? Therefore, this study aims to formulate and analyse effective mathematics learning strategies in developing students' numeracy skills at Budibakti State Primary School in Cianjur Regency.

The novelty of this study lies in the development of integrated and contextual mathematics learning strategies tailored to the characteristics of primary school students. This model combines a problem-based learning approach, differentiated learning, interactive media, and numeracy-based formative assessment. This research not only offers alternative learning strategies but also provides practical contributions to improving the quality of numeracy education in primary schools in accordance with the Merdeka Belajar (Freedom of Learning) and Minimum Competency Assessment (AKM) policies.

2 Method

This study utilised a qualitative approach with a case study method, as it aimed to gain an in-depth understanding of the process of implementing mathematics learning strategies in developing the numeracy skills of primary school students. The qualitative approach was chosen to describe the learning phenomenon as it naturally occurs in the field in a naturalistic and contextual manner [27]. The case study method allows researchers to explore in depth the learning strategies applied by teachers and identify the factors that influence their success [28] in improving the numeracy competencies of students at Budibakti State Primary School in Cianjur Regency.

This research was conducted at Budibakti State Elementary School in Cianjur Regency, West Java, because this school is implementing various learning innovation efforts to improve student literacy and numeracy. This location was selected purposively based on the consideration that teachers at this school have tried to apply a more contextual learning approach. The research was conducted over six months, from January to June 2025, covering the stages of preparation, data collection, analysis, and research report writing.

The research subjects consisted of upper-grade mathematics teachers (grades IV–VI) who acted as the main implementers of the learning strategy, primary school students who participated in the learning activities, and the school principal as a key informant who provided information related to policies and support for the implementation of mathematics learning. In addition, students' parents were also used as additional informants to determine the impact of numeracy learning on children's learning behaviour at home. Participants were selected using purposive sampling, which is a technique of selecting informants who are considered to have the best understanding of and are directly involved in mathematics learning activities at school [29].

The data in this study were collected through four main techniques, namely participatory observation, in-depth interviews, documentation studies, and field notes [29]. Observations were made directly in the classroom learning process to observe teacher and student interactions and the application of learning strategies in the context of numeracy. In-depth interviews were conducted with teachers, students, and school principals to gain a broader understanding of their experiences and perceptions of mathematics learning. Documentary studies were used to examine lesson plans, student assessment results, and other supporting documents. Meanwhile, field notes were used to record the researcher's reflections and observations during the research process.

Data analysis was conducted interactively and continuously with reference to the Miles and Huberman (2014) model, which includes three stages, namely data reduction, data presentation, and conclusion drawing [29]. In the data reduction stage, the researcher selected and focused on information relevant to the research objectives. Next, the data is presented in the form of narratives, tables, and themes so that it is easy to interpret. The final stage is drawing conclusions and verification to find patterns, relationships between categories, and formulate effective learning strategies to improve students' numeracy skills.

To ensure data validity, researchers used source, technique, and time triangulation techniques, as well as member checks and audit trails. Source triangulation was carried out by comparing information from teachers, students, and principals, while technique triangulation was carried out by checking the consistency of the results of observations, interviews, and documentation [28]. Time triangulation was conducted by collecting data at different times to ensure consistency of information. Member checks were conducted by requesting confirmation from informants regarding the accuracy of interview results, while audit trails were applied through systematic recording of the entire research process. Thus, the data obtained is believed to have a high level of validity, reliability, and credibility in accordance with qualitative research standards.

3 Results

Based on in-depth interviews and field observations, teachers use the PjBL learning method by introducing complex and relevant problems to students to stimulate their interest and curiosity. These problems become the main stimulus for learning. Students and teachers plan strategies and steps to solve problems individually or in groups. Teachers organise students into small groups for collaboration. Students conduct investigations, including data collection and research, and analyse information to gain a deeper understanding of the problem and find solutions based on relevant theories and concepts. Students formulate and present their findings or solutions in the form of reports, presentations, or other creative products, showcasing their understanding and work. The learning process is evaluated in terms of both results and problem-solving processes.

Using the problem-based learning (PBL) method shows a significant improvement in numeracy skills. For example, the percentage of students' speaking skills increased

from 52% in cycle I to 75% in cycle II, demonstrating the effectiveness of this model in gradually improving numeracy through several learning cycles.

3.1. Contextual Mathematics Approach

Teachers relate mathematical material to situations experienced by students in their daily lives, such as addition, subtraction, multiplication and division in the context of buying and selling, measuring real objects, or calculations in everyday activities. Students are guided to conduct experiments, search for facts and solve problems independently through practical activities or contextual inquiry. Examples include using teaching aids, contextual animated videos, or real-life cases that require mathematical problem solving. Learning is made interactive through group discussions, cooperation between students, and reflection on their experiences so that students are active in constructing mathematical concepts and relating them to their own experiences.

CTL learning that links mathematical material to local culture and traditional games has also been proven to strengthen students' numeracy competencies. Students' numeracy scores increased from an average of 53.8 on the pretest to 81.6 on the posttest, indicating that contextual and meaningful learning is more effective for students.

3.2. Differentiated Learning

Teachers identify students' readiness to learn, interests, and learning profiles in order to understand the different characteristics of their students. The material is taught differently according to the students' level of knowledge or learning style, for example, some learn visually, auditorily, or kinesthetically. Students are given flexibility in how they understand the same material, for example through discussion, experimentation, or different media. Students can demonstrate their understanding through various products such as presentations, posters, videos, plays, or writings of their own choosing.

3.3. Use of Interactive Media and Strategies

Teachers use various types of media such as images, photos, graphics, videos, animations, and interactive media (e.g. multimedia presentations, digital simulations) to explain learning materials. These media help convey messages visually and concretely so that students can more easily understand abstract and complex concepts. Students actively participate through dialogue, question and answer sessions, discussions, group work, and the use of interactive media that allow them to think critically and express their opinions.

3.4. Integrated Formative Assessment of Numeracy

Collecting data on students' initial abilities, grouping them based on assessment results, scheduling structured assessments, providing constructive feedback, and connecting numeracy in various learning contexts to support the effective and sustainable improvement of students' numeracy skills.

3.5. Relevant and applicable learning materials

Teachers develop relevant and applicable learning materials through procedures such as analysing the curriculum, identifying student needs, selecting appropriate materials, developing contextual materials, and integrating materials with everyday life. As a

result, student scores have increased significantly from an average of 65 to 80, and the number of students meeting the minimum passing criteria has increased from 28% to 84%.

3.6. Comprehensive and continuous evaluation system

Teachers implement a comprehensive and continuous evaluation system by designing valid and reliable evaluation instruments, conducting regular evaluations, providing constructive feedback, using evaluation results to improve learning, and reporting evaluation results to relevant parties.

4 Discussion

The interactive mathematics learning strategy as described in the above research results is relevant to Yusuf's (2024) findings that it can improve the numeracy skills of primary school students [30]. This strategy is implemented through various approaches such as PBL, CTL, differentiation, and interactive learning. This model focuses on solving real-world problems, which makes students more actively involved and practise the use of mathematical concepts [31]. Research shows that the application of PBL significantly improves students' numeracy skills because students are encouraged to think critically and creatively in solving problems.

Using problems and questions directly related to students' daily lives makes mathematical concepts easier to understand and more relevant. This approach improves conceptual and numeracy understanding because students see the function of mathematics in various real-life situations. This is in line with the Realistic Mathematics Education (RME) theory, which states that mathematics learning oriented towards conceptual understanding through the application of real-life contexts and everyday problems encourages students to actively engage in relating mathematical concepts to their empirical experiences. This approach has been proven to be highly effective in improving students' conceptual understanding and numeracy skills [32].

Learning models that adapt to the needs and learning styles of each student can significantly improve numeracy skills. Differentiated modules help teachers meet individual learning needs so that learning outcomes are optimised. Media such as picture number cards and numeracy discussion strategies (contextual discussions) can motivate learning, increase student participation, and make it easier for students to understand numeracy concepts. Assessments that specifically evaluate numeracy skills can help teachers identify needs and adjust learning strategies to focus on improving these skills.

Teachers create innovative and contextual learning designs through procedures that identify student characteristics, select appropriate learning approaches, develop relevant learning materials, create a pleasant learning atmosphere, and implement learning effectively (Salafudin et al., 2021). Learning using contextual problems will make it easier for students to understand the concepts of the material and make students feel interested and challenged to participate in learning [33].

Mathematics learning models have a significant influence on improving students' conceptual understanding, particularly in understanding learning materials. Students

are brought to real situations that are relevant to the mathematical concepts being studied. Innovative and contextual mathematics learning can increase student motivation, make learning more meaningful, and help students understand mathematical concepts better [34].

Teachers apply interactive and enjoyable learning methods through procedures that design learning activities that actively involve students, use interesting learning media, provide positive feedback, create a conducive classroom atmosphere, and implement learning creatively. The use of learning media in mathematics plays an important role because it can increase students' interest in learning.

A comprehensive and continuous evaluation system serves as a tool to measure the overall learning progress of students, provide feedback for improving the quality of learning and curriculum, and ensure transparency, accountability, and sustainable quality of education.

5 Conclusion

This study concludes that an effective mathematics learning strategy for developing primary school students' numeracy skills is one that is innovative, contextual, and oriented towards students' learning needs. This strategy integrates several approaches, namely Problem-Based Learning (PBL), Contextual Teaching and Learning (CTL), differentiated learning, the use of interactive media, and formative assessment focused on numeracy.

The application of the PBL model has been proven to improve students' critical thinking and numeracy skills through solving real problems that are relevant to their lives. The contextual approach makes learning more meaningful because students can relate mathematical concepts to their daily experiences, which has an impact on increasing motivation and conceptual understanding. Differentiated learning allows teachers to tailor methods and materials to students' characteristics and learning styles, so that each student has the opportunity to learn optimally.

In addition, the use of interactive media and collaborative strategies increases student participation and facilitates understanding of abstract concepts. Integrated numeracy formative assessment helps teachers monitor students' progress on an ongoing basis, provide constructive feedback, and tailor learning strategies to students' needs.

Thus, an effective mathematics learning strategy for developing students' numeracy skills is a model that places students as active subjects of learning, relates concepts to real-life contexts, accommodates individual differences, and utilises continuous assessment for learning improvement. This model is in line with the principles of the Merdeka Belajar (Freedom of Learning) policy and the implementation of the Minimum Competency Assessment (AKM), which emphasise the importance of literacy and numeracy as the foundation of 21st-century skills.

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