



Development of Contextual Teaching Materials Based on the Surrounding Environment in Mathematics Lessons for Elementary School Students

Nurjannah¹©, Syarifuddin², Andi Wahdania AM³, Salmawati⁴, Nur Hikmah⁵, Haerati⁵, Nurul Aliyah⁶

¹Tadris Matematika, Universitas Islam Ahmad Dahlan

²Universitas Negeri Makassar

^{3,4,5}Pendidikan Guru Madrasah Ibtidaiyah, Universitas Islam Ahmad Dahlan

Author Correspondence E-mail: nurjannah310807@gmail.com

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Abstract

This study aimed to develop contextual teaching materials based on the surrounding environment in Mathematics for third-grade elementary school students. The subjects in this study were 25 third-grade students from SD Negeri 286 Pasaka. The instruments used in this study were a needs analysis questionnaire and a student response questionnaire to determine any increase in knowledge before and after the teaching materials were used. The development model used was ADDIE, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. The needs analysis results indicate that teachers and students need teaching materials relevant to the surrounding environment to improve their understanding of mathematical concepts. The design process was carried out by linking mathematical materials, such as arithmetic operations, measurements, and plane figures, with real situations around the students. The teaching material products were then validated by material and media experts and tested on third-grade students at SD Negeri 286 Pasaka. The effectiveness evaluation using n-Gain analysis was 0.621, which was in the “moderate” category while the student response questionnaire showed that the total score was 2100 out of a maximum total criterion score of 2500, resulting in a percentage of 84% so that the developed teaching materials were included in the “very effective” category. Meanwhile, the class teacher gave a score of 92 out of a maximum total score of 100, which is equivalent to a percentage of 92% and is included in the “very effective” category. This study concludes that contextual teaching materials based on the surrounding environment are effective in improving the quality of mathematics learning in elementary school.

Keywords: contextual teaching materials, mathematics, surrounding environment, elementary education

1. Introduction

Mathematics is one of the core subjects taught in elementary school (Haris & Nurjannah, 2022; Yeh et al., 2019). Mathematics plays a crucial role in everyday life is very important, from simple activities such as calculating shopping money to solving problems in various fields of science and technology (Agbata et al., 2024; Atti et al., 2023). Therefore, mastery of basic mathematical concepts must be instilled from an early age through effective and meaningful learning.

However, in practice, mathematics learning in elementary schools faces various challenges. One of the main challenges is students' perception of mathematics as a difficult, abstract, and less relevant subject to their lives (Mutmainna & Nurjannah, 2023; Putra & Yulanda, 2021). This often causes students to be less motivated, have difficulty understanding the material, and show poor learning outcomes (Handayani & Mahrita, 2021). This condition is exacerbated if the teaching materials used



are textual, monotonous, and not in accordance with the context of students' lives (Hutagalung et al., 2023; Pramudya & Safrul, 2022).

Elementary school education, especially in grade III, should provide concrete and contextual learning experiences (Rahmah, 2021; Sidekli et al., 2018). According to Piaget's theory, students at this age are in the concrete operational development stage, which means they find it easier to understand concepts when associated with real objects or direct experiences (Melasevix et al., 2021). Therefore, mathematics learning needs to be designed with an approach that involves real contexts so that students can gradually understand abstract concepts (Asyiah et al., 2022).

The contextual approach (Contextual Teaching and Learning/CTL) offers a learning strategy that links subject matter to students' real-life situations (Rahayu et al., 2023). CTL emphasizes the importance of students building knowledge through active involvement in learning situations relevant to their world. In the context of mathematics learning, this approach can help students see that mathematics is not only in books but is also present in their daily lives (Sulastri, 2016; Suryawati & Osman, 2018). Contextual learning makes learning more meaningful and productive because students are actively involved in discovering their own knowledge, encouraging them to think critically and creatively, and increasing their learning motivation because the learning material is linked to real life (Afni & Hartono, 2020; Suryawati & Osman, 2018).

The environment around students holds significant potential as a source of contextual mathematics learning (Nurlita & Jailani, 2023). For example, buying and selling activities in traditional markets can be used to teach the concepts of addition and subtraction, flat shapes can be found in objects around the house or school, and the concept of measurement can be learned through weighing or measuring the length of objects in the surrounding environment (Nurhaliza & Lingga, 2024). Unfortunately, this potential has not been widely utilized in the teaching materials currently available for the subject.

The Independent Curriculum currently implemented in Indonesia emphasizes the importance of student-centered, experience-based, and real-life relevant learning (Halim et al., 2023). One implication is the need to develop contextual and flexible teaching materials that can encourage students to think critically and solve problems (Salma, 2020). The development of mathematics teaching materials based on the surrounding environment can be a form of innovation to support the implementation of the Independent Curriculum in elementary schools in Indonesia.

Based on this background, this study aims to develop contextual teaching materials based on the surrounding environment in mathematics for grade III elementary school students. The teaching materials developed are expected to increase student involvement in the learning process, strengthen the understanding of mathematical concepts as a whole, and foster a positive attitude towards mathematics. In addition, these teaching materials can also be a reference for teachers in designing more creative, fun, and meaningful learning experiences.

2. Method

This research is a research and development study that aims to produce contextual teaching materials based on the surrounding environment in mathematics subjects for grade III Elementary School students. The development model used in this study is the ADDIE model, which consists of five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. This model was chosen because it has a clear flow in the process of designing and developing effective learning products.

The first stage is Analysis, which aims to identify the needs of students and teachers for contextual mathematics teaching materials. The analysis was carried out by collecting data through interviews with grade III teachers, distributing questionnaires on needs to students and teachers, and studying the documentation of the curriculum, syllabus, and teaching materials used at SD Negeri 286 Pasaka. In addition, observations were made of the environment around the school that has the potential



to be used as a source of contextual mathematics learning. The results of this analysis are the basis for designing teaching materials that are in accordance with the characteristics of the students and the local conditions of the school.

The second stage is Design, which involves designing the structure and content of teaching materials based on the results of the analysis. At this stage, the researcher determined the contextualized grade III mathematics material, such as arithmetic operations, plane figures, and measurements. In addition, an initial design of teaching materials was prepared that contained illustrations from the students' surroundings, interactive learning activities, and student worksheets. The design also includes the preparation of evaluation instruments in the form of practice questions, question grids, and worksheets that are aligned with the learning objectives.

The third stage is Development, which involves the creation and validation of teaching materials. The designed teaching materials were developed into initial products and then validated by material and media experts. Validation was performed to assess the quality of the content, language, presentation, and graphic aspects of the teaching materials. The instrument used was a validation sheet with an assessment scale and a suggestion column. The validation results were used as a reference for revising teaching materials to make them suitable for testing.

The fourth stage is Implementation, which is carried out by testing teaching materials on grade III students of SD Negeri 286 Pasaka. The trial was conducted in the form of direct learning during several meetings. At this stage, researchers observe student engagement, ease of use of teaching materials, and the student responses to learning. To measure the effectiveness of teaching materials, instruments are used in the form of pre- and post-tests, as well as student response questionnaires to the teaching materials used. The fifth stage is Evaluation, which aims to assess the final quality of teaching materials and their impact on the process and student learning outcomes. Evaluation is carried out formatively at each stage to improve weaknesses, as well as summative evaluation at the final stage to determine the feasibility and effectiveness of the product. The effectiveness of the teaching materials was also measured through the improvement of student learning outcomes using n-Gain analysis. Meanwhile, questionnaire data were analyzed descriptively to describe student and teacher responses to the teaching materials. The data were analyzed using the following modified percentage formula (Hobri, 2010):

$$\% \text{Student/teacher perception} = \frac{\text{Total data score}}{\text{Total criteria score}} \times 100\%$$

The overall score from the percentage results was converted into an effectiveness criteria table using this method (Hobri, 2010). Kriteria efektivitas bahan ajar dijelaskan dalam Tabel 3.

Table 3. Effectiveness Criteria

Interval Percentage	Criteria
85% - 100%	Very Effective
70% - 84%	Effective
50% - 69%	Quite Effective
0% - 49%	Not Effective

This study will last for 3 months, from March to May 2025. The subjects of this study were 25 grade III students of SD Negeri 286 Pasaka. The study was conducted in Kahu District, Bone Regency, South Sulawesi. The involvement of grade III teachers is also important in the process of needs analysis, validation of teaching material content, and implementation in the classroom. Through the ADDIE model approach, it is hoped that the teaching materials developed can increase student involvement, understanding of concepts, and interest in learning mathematics.

3. Results and Discussion

3.1. Needs Analysis



The needs analysis results indicate a high urgency for developing contextual mathematics teaching materials based on the surrounding environment for grade III students at SD Negeri 286 Pasaka. Based on interviews conducted with grade III teachers, it is known that so far, mathematics learning still uses a conventional approach that focuses on delivering material in an abstract manner and does not involve students' real experiences. Teachers stated that students often have difficulty understanding mathematical concepts because of the lack of connection between the subject matter and their daily lives. Therefore, teachers strongly support the development of contextual and environment-based teaching materials, because they are considered to help students understand the material more easily, increase learning motivation, and encourage active student involvement in the learning process.

In addition to data from teachers, the needs analysis was also strengthened by the results of a questionnaire distributed to grade III students. This questionnaire aims to explore students' perceptions and needs regarding the teaching materials they have been using so far, as well as their expectations for teaching materials that are more interesting and easier to understand. Of the 25 respondents, 96.76% stated that they felt the need for more interesting and easy-to-understand teaching materials related to their environment. This shows that almost all students are aware of the importance of teaching materials that are in accordance with their daily experiences, such as objects around the house, market, garden, or school, that can be used to explain mathematical concepts in real terms.

This finding shows that there is a match between the views of teachers and the needs of students regarding the importance of developing contextual teaching materials. Both provide a strong signal that teaching materials containing local context and utilizing the potential of the surrounding environment are needed to support meaningful learning. In addition, the results of this needs analysis are an important foundation in the teaching material design stage so that the products developed are truly in accordance with the conditions and characteristics of the students at SD Negeri 286 Pasaka.

This is in line with Piaget and Vygotsky's constructivist learning theory, which emphasizes the importance of linking learning materials to students' real experiences so that they can build a deeper and more meaningful understanding (Utami, 2016). The finding that 96.76% of students need contextual teaching materials also confirms that the relevance of context in learning is a major factor in increasing motivation and learning engagement (Mulyanti & Fasya, 2024).

3.2. Design

The design stage in developing contextual teaching materials based on the surrounding environment in Mathematics for grade III students of SD Negeri 286 Pasaka was carried out based on the findings from the previous analysis stage. The design process begins with determining basic competencies (KD) and learning indicators in accordance with the applicable curriculum, especially materials that are relevant to contextualize, such as number arithmetic operations, measuring length, weight, and time, and recognizing flat shapes. These materials were chosen because they are closely related to real activities and objects around students, such as shopping at a stall, measuring the length of a table, counting the number of fruits, and recognizing the shape of objects in the school yard. Furthermore, the structure of the teaching materials was designed to include an introduction, learning objectives, presentation of contextual materials, student activities, practice questions, and assessments. In this design, each mathematical concept is packaged through a contextual approach that involves stories or real situations in the students' environment, such as village markets, school gardens, and household activities. Visualization is also designed attractively using colored illustrations that are in accordance with students' local realities to strengthen the appeal and understanding of the material. Learning activities are designed to be interactive and encourage active student involvement, such as measuring objects around the classroom, counting fictional shopping items, and drawing flat shapes based on the shapes of objects in their surrounding environment.

In addition, at the design stage, evaluation tools were prepared in the form of practice questions and student worksheets that were adjusted to the local context and abilities of grade III students. These questions are designed not only to measure conceptual understanding but also students' skills in



applying mathematics in real life. The evaluation instruments also included assessment rubrics for teachers, student engagement observation sheets, and student response questionnaires for teaching materials. All of these elements are arranged in a single design for printed teaching materials, which will be further developed in the next stage.

The design of these teaching materials was carried out by considering the principles of readability, suitability of students' cognitive development levels, and continuity between learning objectives, activities, and assessments. The results of this design stage are the main reference in the process of developing teaching materials in the next stage, to ensure that the products produced are not only appropriate in terms of content, but also attractive, easy to use, and in accordance with the needs of students and teachers at SD Negeri 286 Pasaka.

This stage emphasizes the connection between mathematics material and the students' environment in accordance with the principles of contextual learning that emphasize the connection of learning content with real-world situations to make it easier for students to understand abstract concepts (Aminuddin, 2023). This approach is also supported by Gardner's theory of multiple intelligences, which emphasizes the importance of presenting various ways of learning, including through contexts that are close to students' lives (Nurlita & Jailani, 2023). In this study, the design of teaching materials that integrate stories, illustrations, and real activities in the surrounding environment supports the diversity of students' learning styles.



Figure 1. Cover Design

3.3. Development

The development stage is the realization stage of the previously designed design, namely by producing contextual teaching materials based on the surrounding environment in Mathematics for grade III students of SD Negeri 286 Pasaka in printed form. These teaching materials are developed in the format of student books equipped with colored illustrative images, short stories that describe real situations in the environment around students, and learning activities that stimulate active involvement of students. Each material is linked to the context of everyday life, such as shopping at a stall, measuring the length of a table or door, weighing fruit, and recognizing flat shapes through objects in the school environment. The use of simple, communicative language, and in accordance with the level of student development, is also a major concern at this stage so that the teaching materials are easy to understand and enjoyable for students. After the teaching materials were developed, the initial product was validated by two experts, namely, material and media experts. Validation was carried out using an assessment sheet that included aspects of content feasibility, language, presentation, and graphics. The validation results from material experts show that the teaching materials are considered feasible, with suggestions for improvement in the preparation of learning indicators to be more detailed. Meanwhile,



media experts provided input to enlarge the font size in several sections and adjust the background color contrast to make it more friendly to children's eyesight. Based on suggestions from the validators, revisions were made to the initial product, especially in the layout and refinement of the explanatory sentences.

After the revision process, the teaching material was ready to be tested in the next stage. In this development stage, guidelines for the use of teaching materials by teachers were also prepared, including examples of use in classroom learning activities. This step aims to ensure that teachers can utilize teaching materials optimally and in accordance with the expected learning objectives. Overall, this development stage produces teaching material products that are not only appropriate in terms of content and appearance, but also in accordance with the characteristics of students and the environment in which they learn.

At this stage, expert validation showed that this teaching material was appropriate in terms of content and media, which reflects the principles of developing effective teaching materials according to Dick and Carey, namely that the material must meet the aspects of clarity of content, language appropriateness, and visual appeal (Hutabarat, 2015).

Based on the validation results by experts, the content aspect obtained an average value of 3.87, indicating that the teaching materials were valid and suitable for use. As for the media display aspect, the design quality obtained an average value of 3.66 (very valid), and media efficiency 3.53 (very valid), with a total average of 3.59, indicating a very valid category. These results indicate that the display of teaching materials was deemed appropriate and very supportive of the learning process.

3.4. Implementation

The implementation stage in this study was carried out by applying contextual teaching materials based on the surrounding environment to the mathematics subject in Class III of SD Negeri 286 Pasaka. The implementation was carried out for three meetings, each lasting 2×35 min. The materials used in the limited trial included arithmetic operations, measuring length, and introducing flat shapes, which had previously been linked to the context of the students' surroundings. Before the learning activities began, the teachers were given a brief explanation and training related to the use of teaching materials so that implementation in the classroom could run according to the plan and objectives that had been designed.

During the implementation process, the researchers conducted direct observations to record teacher activities and student involvement in the learning process. Observations focused on student responses to the material presented, participation in contextual activities, and interactions with pictures, stories, and questions contained in the teaching materials. The results of the observations showed that students appeared enthusiastic and more active in their participation in learning. They were able to link mathematics to everyday experiences, such as calculating the price of goods at a shop or measuring objects in the classroom using simple tools. Learning activities became livelier and more communicative compared to learning through conventional teaching methods.

In addition to observation, implementation also includes administering an initial test (pretest) and a final test (posttest) to measure the improvement in student learning outcomes after using the developed teaching materials. Initial results showed a significant increase in average scores between the pretest and posttest, indicating that the teaching materials helped students understand the material better. In addition, the student response questionnaire to the teaching materials showed that most students felt happy and motivated to learn because the material was presented in an interesting form, was close to their lives, and was easy to understand.

Teachers also provided positive feedback on these teaching materials. According to the third-grade teacher, these contextual teaching materials not only help students understand mathematical concepts more concretely but also make it easier for teachers to connect the material with students' real experiences. The teacher considered that this book had great potential for application in daily learning and hoped that it could be used continuously. In general, the implementation stage showed that the



developed teaching materials were feasible and effective for use in the mathematics learning process in the third grade of SD Negeri 286 Pasaka.

The implementation of teaching materials resulted in a significant increase in student learning outcomes, as indicated by the increase in pre- and post-test scores and high student participation during learning. This supports the findings of several previous studies, which state that the use of contextual teaching materials can improve students' understanding and learning motivation (Aminuddin, 2023; Rahmah, 2021). In addition, teachers' positive responses to these teaching materials confirm that relevant and easy-to-use teaching materials can help teachers in the learning process, increase teaching effectiveness, and facilitate the achievement of learning objectives (Laili, 2019).

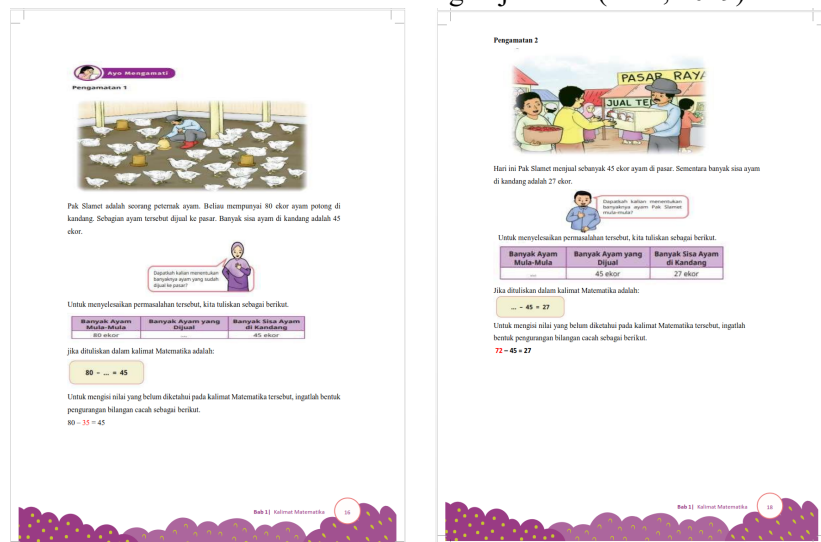


Figure 2. Contents of the Module Section

3.5. Evaluation

The fifth stage in the ADDIE development model is evaluation, which aims to assess the final quality of the teaching materials and their impact on the process and learning outcomes of students. Evaluation is carried out in two forms: formative and summative. Formative evaluation is conducted at every stage of development, starting from analysis, design, development, and implementation. The aim was to identify deficiencies and weaknesses in teaching materials and improve them based on input from material experts, learning design experts, and class teachers. Summative evaluation is conducted at the final stage to determine the feasibility and effectiveness of teaching materials as a whole. One form of summative evaluation is the analysis of student and teacher perception questionnaires on the developed teaching materials. From the results of filling out the questionnaire by 25 grade III students of SD Negeri 286 Pasaka, a total score of 2100 was obtained from a total maximum criterion score of 2500, resulting in a percentage of 84%. Based on the effectiveness criteria of Hobri (2010), this value was included in the "effective" category. Meanwhile, the class teacher gave a score of 92 out of a maximum total score of 100, which is equivalent to a percentage of 92% and is included in the "very effective" category.

In addition, the effectiveness of the teaching materials was measured through the improvement of student learning outcomes using n-Gain analysis. The results of the pretest and posttest showed an average n-Gain of 0.621, which is in the "moderate" category. This shows a significant increase in learning outcomes after using contextual teaching materials based on the surrounding environment.

Thus, based on the results of the formative and summative evaluations, it can be concluded that the teaching materials developed are feasible and effective for use in mathematics learning in elementary schools. These teaching materials can increase student involvement, strengthen conceptual



understanding, and increase interest in learning in a more contextual and meaningful learning atmosphere.

The evaluation shows that the teaching materials developed are not only effective in improving learning outcomes but also provide a high level of satisfaction for students and teachers. This high level of satisfaction strengthens Keller's concept of the ARCS model (Attention, Relevance, Confidence, Satisfaction), which states that interesting and relevant teaching materials will increase students' motivation and learning satisfaction (Asiani & Nugroho, 2017). In addition, suggestions for enriching practice questions and supporting materials indicate the need for literacy and continuous improvement in the development of teaching materials, in accordance with the cyclical and interactive ADDIE principles (Nurjannah et al., 2023). Overall, this study shows consistency between contextual learning theory and empirical results that support the effectiveness of environment-based teaching materials in mathematics learning. This also opens up opportunities for the development of broader and more diverse contextual teaching materials to improve the quality of basic education, especially in mathematics learning, which is often considered abstract and challenging by students. Conclusions can be generalizations of findings according to research problems or recommendations for further steps.

4. Conclusions

Based on the results of the research and development that have been conducted, it can be concluded that contextual teaching materials based on the surrounding environment are effective for use in mathematics learning for grade III Elementary School students. The development of teaching materials with the ADDIE model produces products that are in accordance with the needs of students and teachers and are relevant to local school conditions. The developed teaching materials can increase student involvement, facilitate understanding of mathematical concepts, and significantly improve student learning outcomes. Validation by experts and implementation results in the classroom show that these teaching materials are feasible and effective for use in the learning process.

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