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Preserving culture in education: Learning Media Innovation for Building Spaces Based on Temple Architecture

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Abstract: The ability of fifth-grade students at SDN Penataran 06 to understand the concept of building space is still low, despite the importance of this material in the field of geometry, especially in everyday life. This study aims to develop local wisdom-based learning media with a theme centered on building space, inspired by the unique features of Penataran Temple. The research method used is Research and Development (R&D) with the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). Based on questionnaire results, 98% of students reported an increase in their understanding of the learning material when the media was used effectively. Furthermore, 92% of educators acknowledged that the use of this media encouraged increased active participation from students in the classroom. This research demonstrates that local wisdom-based learning media can serve as an effective alternative in enhancing the quality of mathematics education in elementary schools.

INTRODUCTION

Mathematics is a branch of science whose truth is fixed and cannot be doubted because it is based on logical reasoning organized in a consistent system. In mathematical proof, a statement is considered true if the basics that support it have been proven true (Sinaga et al., 2021). In line with the opinion (Kamarullah, 2017) that mathematics is a field of science that is universal has no restrictions, and is accepted throughout the world. Mathematics is not bound by politics and is not influenced by political interests. Its existence is essential in human life and continues to develop according to needs. Every aspect of human activity involves

the application of mathematics. Therefore, mathematics acts as the basis and main support for the development of other sciences. Meanwhile, according to (Kusumawardani et al., 2018) mathematics develops as a result of human thinking involving ideas, processes, and reasoning. Therefore (Depdiknas, 2006) emphasizes that mathematics learning needs to be given to all students as a basis for developing the ability to think logically, analytically, systematically, critically, and skillfully at work.

Mathematics consists of various concepts and structures that are interconnected. This science includes a system of thinking, symbolic language, and various methods used to analyze, solve problems, and describe phenomena in various fields (Rachmantika et al., 2019). In general, mathematics is divided into five main branches, namely arithmetic, geometry, algebra, analysis, and basic mathematical logic. Some of the scope of one of them is geometry which discusses building space. Spaces are three-dimensional geometric objects that have length, width, and height dimensions, which are bounded by flat planes called sides (Sipayung, 2018). This is proof that mathematics can train students to develop their ability to understand, identify, and apply to problems in the real world. As stated by (Marfu'ah et al., 2022) Mathematical ability includes the ability to think logically and critically in facing and solving problems. This problem-solving is not limited to routine problems but also includes problems encountered in everyday life.

From the opinions that have been expressed by experts, it can be concluded that theoretically, students should be able to understand the importance of learning mathematics (Tampubolon et al., 2019). However, in practice, there are still many students who have not reached the indicators of understanding mathematical concepts in the learning process, so they face difficulties both in understanding the material and in solving math problems. The results of the research (Christidamayani et al., 2020) found that students have difficulty learning geometry material, especially building space. This difficulty is not only caused by the complexity of the material but also influenced by various internal and external factors, including low learning motivation. Many students find

geometry difficult to understand and confusing, so they tend to be reluctant to study it in depth. According to (Marthani et al., 2022) students have difficulty in learning mathematics, especially in geometry material, which is caused by several factors, such as understanding complex concepts, limitations in abstract thinking, difficulty in integrating various forms of geometry in one problem, and negative mindset towards mathematics.

The causes of students' lack of understanding of mathematical concepts, especially building space, as described by learners have difficulty in understanding and answering questions, especially related to contextual problems and the preparation of mathematical models. In addition, learners also face obstacles in discussions, determining the right strategy, and skills in calculations, especially in the application of operation signs and numerical accuracy. Other difficulties appear in the inability of learners to solve problems, which is reflected in the difficulty in writing the steps of solving story problems correctly, such as lack of planning and re-examination of work results. As the results of research (Farhana et al., 2022) concluded teachers have the responsibility to support the creation of meaningful learning and facilitate the learning process. One way is to understand the use of concrete media to make learning more interesting. In addition, the results of research (Wijaya et al., 2021) also show that concrete media can increase interest in learning Mathematics in grade V students. This finding underlines that concrete media has the potential to be an effective alternative for teachers in optimizing the learning process in the classroom. In addition, concrete media is flexible because it is easy to find in the surrounding environment. Research (Yunanda Pradiani et al., 2023) also says that concrete learning media is considered effective because it helps students understand abstract concepts through visual and practical experiences. This media can increase interest in learning, facilitate understanding, and support meaningful learning by connecting material to everyday life.

The method used to analyze students' difficulties in learning mathematics has proven to be effective, as shown by the improvement of students' understanding and learning

outcomes. The results of research conducted by (Ali et al., 2023) show that the use of concrete media affects the understanding of students' mathematical concepts. Based on the analysis, the average pretest score in the experimental class was 70.8, and after using concrete media, the average posttest score increased to 76.2. Thus, there was an increase of 5.4 between the pretest and posttest scores. According to (Adhiyah, 2023) learning with the help of concrete media has proven effective in improving student learning outcomes. This media helps students understand the material through real objects, not just abstract concepts so that learning becomes more meaningful. This can be seen from the increase in the average class score, from 68.8 in cycle I to 78.8 in cycle II. Learners are also more active and motivated during the learning process.

The learning media for this space-building box is called Bara Box or space building box which was inspired by the Development of Eco-Friendly Based Space Building Box Media in Mathematics Learning to Improve Critical Thinking of Grade II Elementary School Students development of space building box learning media in mathematics learning to improve critical thinking of grade II students (Afifah et al., 2023). The Bara Box media design is also inspired by the Claws Box learning media on the material of spatial and flat figures used in this study which is a learning media in the form of an elevated beam and there are spatial and flat figures of various colors. In addition, this learning media provides a way to distinguish between the sides and corner points of each workpiece of spatial and flat shapes (Saraswati et al., 2022). Bara Box learning media also has an architectural theme inspired by the results of ethnomathematics exploration in the Karang Bayan Ancient Mosque Building can be implemented into classroom learning in classrooms that contain geometry geometry concepts, namely spatial and flat shapes (Aini et al., 2023).

This research focuses on the material of building space in elementary school because this material is the initial introduction of geometry concepts to students. However, there are still many learners who have difficulty understanding the characteristics of spatial shapes, such as the relationship

between sides, ribs, and angles. To overcome this, this research proposes the involvement of learners in the learning process as a solution to improve understanding of mathematical concepts. The media used is a spatial box that is designed to be more interesting so that students can be actively involved, both individually and in groups. The box was developed with contents in the form of miniature buildings and step guide cards so that learners can arrange them into architectural models of temple buildings. As a basis for needs analysis, researchers have conducted observations of elementary school teachers.

Mathematics learning at the elementary school level requires support in the form of demonstrations in the presentation of material. This aims to make mathematics more meaningful so that the material can be conveyed clearly to students. In this research, the demonstration is designed so that students can independently demonstrate the props that have been provided in the building space box. Thus, learners can operate and conduct their demonstrations by the agreement that has been set. This research is in line with previous research on Teaching and Learning Geometry: early foundations (Clements et al., 2018). Then Improving Math Creative Thinking Ability by using Math Adventure Educational Game as an Interactive Media (Kartika et al., 2019).

METHOD

This research uses the Research and Development (R&D) method, with the ADDIE model (Analyze, Design, Development, Implementation, Evaluation). The ADDIE model is one of the learning design models that is systematically organized (Maydiantoro et al., 2020).

The ADDIE model has 5 stages:

Analyze, the initial stage, involves a series of important activities. First, it analyzes the competencies that learners must have. Next, learners' characteristics are analyzed, including learning capacity, skills, abilities, attitudes, and other relevant aspects that can affect the learning process. Finally, the learning materials are analyzed based on the competency demands, so that the selected materials can support the achievement of learning objectives optimally.

Designing is a process that is done systematically based on well-organized guidelines. The first step in this process is to determine who is the main focus of learning, namely students. After that, learning objectives are determined in the form of competencies or skills that are expected to be mastered by students. The next step is to design effective and efficient learning strategies so that learners can understand the material or skills well. Finally, assessment and evaluation methods are developed to measure the extent to which learners have mastered the material or skills taught.

Development is an important process that aims to realize design specifications in real form. At this stage, product development is carried out in the form of a prototype which is an initial representation of the design results. All components that have been designed previously, such as the selection of materials that are by the characteristics of learners and competency needs, the learning strategies designed, as well as the assessment and evaluation methods chosen, are realized in a structured manner in the form of prototype development products.

Table 1. Instruments to assess by experts

NO	Aspect	Indicator
		Learning Media Expert
1	Construction	Media is not easily damaged Easy to use media Media is easy to carry around Media does not hurt the skin Media materials are strong
2	Visual design and aesthetics	Media fonts can be seen clearly Color composition of graded media design. Simple media design Attractive media design
	Ease of Use	The use of media is easy to operate by hand.
		Learning Material Expert
1	Appropriateness to Learning Objectives	The material is in accordance with the learning objectives Material in accordance with Learning Indicators
2	Suitability to the Characteristics of Learners	The material is related to the conditions around the learners
3	Language and Presentation	The material can be delivered easily The material presented is easy to understand The language used is clear
4	Interrelationship between materials	Learning evaluation is in accordance with learning indicators The material can

		encourage students' curiosity about learning media materials using visual elements such as images or tables that support understanding
5	Suitability with Supporting Media	The selection of learning media as material for building space is appropriate

The validation test of learning media and learning materials was carried out by media and material expert lecturers from Malang Muhammadiyah University. Media feasibility has several categories that affect the implementation of learning in the classroom.

Table 2 Assessment of media and learning materials by experts

Category	Score
very good	4
good	3
Poor	2
Very poor	1

Implementation is the process of applying the development results to learning. At this stage, the prototype product that has been developed is tested directly in the field to evaluate its effect on the quality of learning. The aspects assessed include the effectiveness, attractiveness, and efficiency of the learning process. This trial aims to obtain a real picture of the extent to which the development product can support learning optimally.

Evaluation, the final stage, involves two types of evaluation: formative evaluation and summative evaluation. Formative evaluation is carried out during each stage to collect data that is used as a basis for improvement and refinement. While summative evaluation is conducted at the end of the program to assess the extent to which the program has influenced learners' learning outcomes and to assess the overall quality of learning.

Table 3 Conversion Criteria for Assessing the Feasibility of Learning Media

Interval	Criteria	information
86% - 100%	Very good	Feasible for field trial
75% - 85%	Good	Feasible for field trial with revision
<75%	Not good	Not suitable for trial

RESULT & DISCUSSION

This study examines the development of learning media for spatial building boxes that have a significant effect on mathematics learning for grade V students. This media is designed to help teachers create an interactive and interesting

learning environment to improve students' understanding of mathematical concepts. This media development process uses the ADDIE model, which includes five main stages, namely Analysis, Design, Development, Implementation, and Evaluation.

Analysis

Based on the results of the literature review, it was found that students' problem-solving and mathematical communication skills tend to be low, especially in schools located in areas with limited educational facilities, inadequate learning resources, or minimal access to technology and interactive learning media. To strengthen these findings, a series of observations, document reviews, and interviews with school administrators, teachers, and students at SDN Penataran 06, Blitar were conducted. Based on the analysis of the data obtained, it is known that mathematics learning at the school does not involve students actively, with learning resources that still depend on conventional textbooks and have not utilized interactive learning media. This condition causes the learning process to take place in one direction, is less interesting and hurts student`s ability in problem-solving and mathematical communication. From the results of this analysis, it can be concluded that the development of interactive and innovative learning media is needed to improve problem-solving and mathematical communication skills in students at SDN Penataran 06.

Design

In the process of designing learning media, several design stages must be carried out to ensure the effectiveness and suitability of the media to the learning needs of students. The first stage is the determination of learning objectives, which becomes the foundation in the preparation of the media flow. Clearly, formulated learning objectives serve as the main foothold in the development of media design. Once the learning objectives are set, the next step is to design the media flow. This flow is usually realized in the form of a storyboard to map the structure of the material presentation and navigation system. This design includes the sequence of information delivery, transitions between sections, and interactive elements, allowing users to follow the learning process in a

structured manner. The next stage is visual design. At this stage, visual elements are designed in such a way as to attract attention while supporting learning objectives. The selection of elements such as colors, fonts, layouts, illustrations, and icons is done carefully to create an aesthetically pleasing appearance that suits the characteristics of the target audience. The last stage is determining the design evaluation criteria, which is designed to assess the extent to which the learning media can fulfill the predetermined objectives. This evaluation includes aspects of aesthetics, ease of use, content relevance, and media effectiveness in supporting the achievement of learning outcomes.

Development

The development stage in the ADDIE model focuses on creating and testing media based on the design. For the building box, the miniature buildings were made from durable materials and accompanied by a storage box and visual guide. For the pop-up book, the book is designed with interactive elements, illustrations, and texts that explain the characteristics of building spaces in an interesting way. After the media was completed, a prototype test was conducted involving users to evaluate the functionality, aesthetics, and effectiveness of the media. Based on the test results, revisions are made to improve the media so that it is ready to be used at the implementation stage.

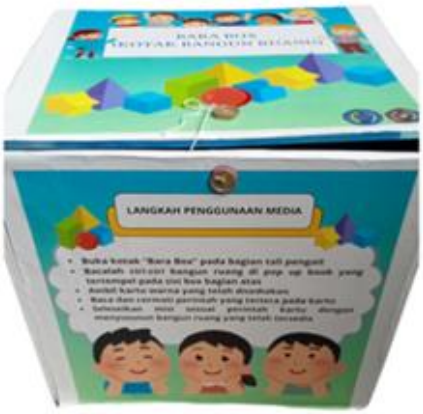

Figure 1 Building container box

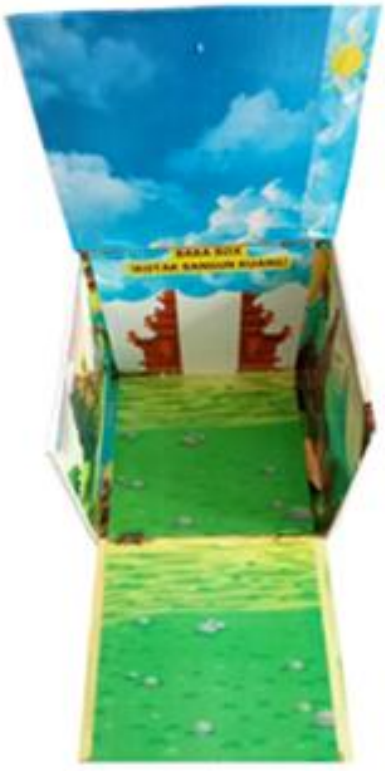

Figure 2 Design in the box

Figure 3 Miniature space building

Validation of media and learning materials is conducted to ensure their quality and suitability to students' needs. This process involves several parties, namely media experts, and material experts. Media experts evaluate the visual design, interactivity, and ease of use of the media, ensuring the media is attractive and easy to operate. Material experts are in charge of checking the accuracy, relevance, and suitability of learning content with learning outcomes in the curriculum. Feedback from experts becomes the basis for improving the media to make it more effective and by learning objectives.

Table 4 Results of media validation test and learning materials

NO	Aspect	Indicator	Score	Category
		Learning Media Expert		
1.	Construction	Media is not easily damaged	3	Good
		Easy to use media	4	Very good
		Media is easy to carry around	4	Very good
		Media does not hurt the skin	3	Good
		Media materials are strong	4	Very good
2.	Visual design and aesthetics	Media fonts can be seen clearly	3	Good
		Color composition of graded media design.	4	Very good
		Simple media design	4	Very good
		Attractive media design	3	Good
3.	Ease of Use	The use of media is easy to operate by hand.	4	Very good
		Learning Material Expert		
1.	Appropriateness to Learning Objectives	The material is in accordance with the learning objectives	4	Very good
		Material in accordance with Learning Indicators	4	Very good
2.	Suitability to the Characteristics of Learners	The material is related to the conditions around the learners	3	Good
3.	Language and Presentation	The material can be delivered easily	4	Very good
		The material presented is easy to understand	3	Good
		The language used is clear	4	Good

4.	Interrelationship between materials	Learning evaluation is in accordance with learning indicators	3	Good
		The material can encourage students' curiosity about learning media	4	Very good
		materials using visual elements such as images or tables that support understanding.	4	Very good
5.	Suitability with Supporting Media	The selection of learning media as material for building space is appropriate	4	Very good

Implementation

The implementation stage includes various important activities, from introducing the learning media to teachers and students to its direct application in the learning process. At this stage, the first step is to provide specialized training to teachers to ensure they understand how to use the Bara Box media. This training is designed so that teachers can operate and utilize the media effectively in teaching and learning activities. After completing the training, it was followed by a trial of using the media with students. This trial aims to evaluate the extent to which students can understand and master the learning media used. As part of this process, teachers also provide Learner Activity Sheets (LKPD), which serve as a tool to measure students' ability and involvement in understanding the material through the media. This implementation stage aims to realize the lesson plan that has been designed previously so that the implementation of learning becomes more effective and directed before continuing to the evaluation stage which will be carried out later.

Evaluation

The evaluation stage of the learning media involves data collection through questionnaires completed by teachers and students and evaluation questions to students. Teachers assessed the relevance, ease, and effectiveness of the media, while students assessed their comprehension and interest. The evaluation was used to develop recommendations for improvement and an evaluation report summarizing the effectiveness of the media as well as further development steps. The average result of the student evaluation questionnaire was 85.5 which means it falls into the very good category. The

student questionnaire showed that 98% of the learning media could be used, and the teacher questionnaire results showed the effectiveness of the media at 92%.

DISCUSSION

The results showed that many 5th-grade students of SDN Penataran 06 Blitar Regency still have difficulties understanding the concept of building space. Given this, it certainly cannot be ignored that this skill is one of the fundamental skills in learning mathematics. The learning process also still uses a contextual learning model because teachers have difficulty finding appropriate learning media. So far, teachers only consider aspects of learning media that are easy to develop. This is in line with the findings of (Hendriani, 2021). The 5th-grade spatial learning media based on Penataran temple architecture as a theme combines geometry concepts with Indonesian cultural heritage, especially in Penataran Village. In the context of mathematics, this media teaches spatial shapes such as cubes, blocks, prisms, and pyramids that can be found in temple structures. By visualizing the temple, students can directly identify and understand the properties of the geometry, such as sides, ribs, and covers. The use of three-dimensional models helps students to know the characteristics of shapes in a real context, making the material more relevant and easy to understand. The media also encourages active engagement through practicum activities, where students can design or create a model of the building, deepening their understanding of the mathematical concepts.

This learning media for building space is named "Bara Box" which means building space box. The media is made like a cube made from wood. This box is used as a container and a place to arrange temple architecture. To make it look more neat and attractive, the box is covered with stickers that carry the theme of temple architecture. Inside the box, there are miniatures of all types of buildings with a total of 200. These miniature buildings are the main material for the temple construction. These miniature buildings are colored according to the shape of the building. Furthermore, the media box also has a pop-up book attached to the top side.

This pop-up book contains the characteristics of each flat shape.

This research is in line with previous research, namely: The Development of Flat Building Learning Media Based on Miniature Houses in Mathematics Subjects Sd (Hendratni, 2016). The difference with previous research lies in the geometry category. Previous studies use the category of flat buildings, while this study uses the category of space buildings. In addition, there are differences in theme, where previous research is based on house architecture while this research is based on temple architecture.

CONCLUSION

This research shows the need for effective learning media to support Mathematics learning, especially in the material of building space in class V SDN Penataran 06. Many students have difficulty recognizing the types and parts of building space. To answer this need, Bara Box Media was developed, which consists of a box, a miniature building, and a pop-up book. This media is designed to help students understand spatial shapes combined with temple shapes. The validation results from material and media experts show that Bara Box Media is considered good and feasible to use, with a score of 92,5% from material experts and 90% from media experts. From the questionnaires filled out by teachers and students, it also shows that Bara Box media is feasible and effective in learning. However, this study has limitations, namely that it was only conducted in one school with a relatively small sample size, so the results cannot be generalized. Therefore, future research is recommended to expand coverage to various schools with a larger population and integrate interactive technologies, such as digital platforms, to improve student engagement and learning outcomes.

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