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Strategy for Learning Space Geometry Concepts in Elementary School Students

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ABSTRACT

Space is an aspect of geometry that is important for students to master, which allows students to analyze and study in reality and helps to operate other material. This research aims to find out the methods and strategies used by teachers in teaching spatial geometry to elementary school students. This type of research uses library research. The data sources used as research material were obtained from 4 (four) journals related to the theme being studied so that the data presented was quite strong and clear. The analysis technique used in this research is content analysis. The results of the research show that the strategy that must be implemented by teachers is to teach the basic concepts of spatial geometry first and use concrete and supportive learning media so that students can understand the concept of spatial geometry in mathematics correctly in real life.

INTRODUCTION

Education is the basis of life for every person because education is part of the initial knowledge that humans must master to socialize. The progress of the era and the increasingly rapid influence of technological developments have resulted in many developments, especially in the education sector. For example, in basic education, technological developments help students to be enthusiastic about learning. The teacher's role as an educator must have adequate skills in teaching material so that it is easy for students to understand. One of the materials at the basic education level that has the potential to take advantage of technological developments in mathematics. The selection and use of appropriate learning strategies can influence students' learning processes and outcomes, especially in mathematics subjects

(Qorri'ah, 2011).

Mathematics is one example of the many subjects that students will always use until they grow up. This subject is expected to have a significant impact on students. These impacts include students' ability to think critically, systematically, realistically, logically, actively, and creatively (Qorri'ah, 2011). Students are also expected to be able to understand basic mathematical concepts and apply them in life. The strategy for teaching mathematics in elementary schools still applies the conventional method. Conventional methods are generally still used by teachers who are not used to applying the use of technology so their teaching methods are monotonous (Pramestika, 2020). In reality, the demands of this era require teachers to innovate from various learning angles, be it strategies, methods, or media. This series of activities can be modified with technological developments (Ibrohim et al., 2021).

The mathematical material that students must master is spatial concepts. This spatial material is usually found in high-class students (grades four to six). For example, the learning difficulties experienced by students are in understanding spatial geometry material. Students in this spatial geometry material generally still have difficulty understanding the differences between angles, sides, and edges in spatial shapes (Suharjana., 2008). Difficulties experienced by students can be caused by internal and external factors. Internal factors are factors that arise from within students, while external factors are supporting factors from outside. These external factors include the teacher's teaching style, use of media, and learning methods. Students as a generation of future society should be well prepared so that teachers as facilitators must be able to build students' thinking and understanding about this spatial material in particular, and other general material (Pramestika, 2020).

Another reality found in the field is that there are obstacles that students find in the geometry of flat-sided and curved-sided space. Research results from Nuraida (2017) show that students find obstacles in sorting and organizing data, using symbols, mathematical manipulation, and understanding procedural concepts. Another opinion by Rosyida *et al*., (2016) stated that students still often make mistakes in solving problems related to building space, including when working on problems, solving them using strategies, and then checking the results of their work. These problems can be overcome by analyzing students' misconceptions about spatial shapes and then finding solutions to the problems.

The material of building space and its various difficulties form a complex whole and must be overcome immediately. Based on the various reasons that have been explained, this research aims to find out the strategies and media used by teachers in teaching spatial materials in

elementary schools.

METODE

This research is classified in the qualitative type through library research also called library research. This research was carried out by utilizing reading sources in the form of journals to obtain data without having to go directly to the field. The research stages begin with the process of collecting library sources obtained from primary or secondary sources. The data analysis technique used in this research is content analysis. Content analysis is research that takes the form of an in-depth discussion of the contents of written or printed information in journals, books, or all other documentation materials. Meanwhile, concerning the discussion, it is one of the author's efforts to facilitate understanding by analyzing the truth which is then used as a research reference. Research was carried out by grouping data based on research formulas (Sari & Asmendri, 2020). Research activities at the advanced stage are collecting information by citing references and then displaying it as the result of complete research to obtain knowledge and draw conclusions. The data sources used as research material were obtained from four journals related to the theme being studied so that the data presented was quite strong and clear.

Table 1. Journals Reviewed in Research

No.	Article Title	Year	Author(s)
1.	Realistic Mathematics Learning to Improve Spatial Geometry Abilities in Elementary School Students.	2014	Intan Kemala Sari (Sari, 2014)
2.	The Effectiveness of Using PowerPoint Media on Mathematics Learning Outcomes in Flat Building Materials and Building Rooms in Elementary Schools.	2020	Lionidha Adhi Pramestika (Pramestika, 2020)
3.	Understanding Learning Mathematical Concepts Using New Fingerboard Media in Elementary School Building Materials Through Online Learning.	2022	Jamilatus Sholehah, Vivin Nor Azizah, Inge Aprilia Putri, Ika Aulia Fitri, Mita Aprilia Faradipa, dan Imron Fauzi. (Sholehah et al., 2022)
4.	Mathematics Content Knowledge for Teaching Elementary Mathematics: Focus on Geometry and Measurement.	2014	Christine Browning, Alden J. Edson, Patrick M. Kimani, dan fatma Aslan-Tutak (Browning et al., 2014))

RESULTS AND DISCUSSION

Strategy for Introducing the Concept of Spatial

The process of recognizing shapes is the initial way a person uses to build the ability to think (Sudrajat et al., 2020; Sari, 2014). Through these tags, a person can understand the

characteristics and properties of objects and forms of objects and then analyze them. One example of aspects of shapes and objects in mathematics is spatial figures. The definition of the spatial structure according to Setyaningsih (2017) is a shape that has length, width, and height while descending Suharjana (2008), space geometry is a shape that is bounded by a collection of points on all its surfaces (the surfaces in question are sides) so, it can also be concluded that space geometry is a three-dimensional shape that has volume and content. Space geometry is divided into two types, namely flat-sided space geometry and curved-sided space geometry.

This research focuses on discussing media and teaching aids that can be used as strategies for learning spatial geometry in elementary schools. The use of media and visual aids can create an effective learning environment because students' knowledge regarding the definition of concepts is not only limited to theory but students' knowledge can be directly linked to problems in everyday life by seeing the media and visual aids directly (Downton et al., 2017). Introducing the concept of spatial geometry to elementary school children can use teaching aids in the form of objects or real objects that may resemble the spatial structure in question, of course, these objects are objects that students can find and obtain in their daily lives. Examples of cube geometric objects are dice, tissue boxes, and Rubik's cubes. Space geometry is divided into two types: flat-sided space geometry and curved-sided space geometry. Teachers can organize spatial geometry learning to suit students' needs so that students can be enthusiastic when studying the material.

Learning Strategy for Flat Side Building Concepts

Learning space geometry is learning that includes understanding, drawings and models of shapes (Nuraida, 2017). In implementing spatial geometry learning, teachers must use concrete media, namely objects that students usually obtain in their daily activities, and then actualize them into semi-concrete forms that are realized through image visualization. The aim of this process is so that students can understand abstract knowledge about spatial shapes that exist in their minds.

In learning about spatial geometry, there are two ways for teachers to teach it to students, namely, first, students are introduced to examples of objects in the real world, and then they are taken to geometric objects or their mathematical shapes. The second way is, that learning begins by teaching students about line points, and flat shapes, then next is space shapes. The aim of this step is for students to have the opportunity to increase their understanding of the structure of space itself. According to Saraswati & Kurniawati (2022) stated the introduction

of various types of spatial shapes as follows:

Types and features of waking up flat side space

Cube

Cube is a type of spatial geometry that has sides with a square shape and has the same length of ribs. Examples of concrete objects such as cubes in everyday life can be found on dice, ice cubes, and rubiks.

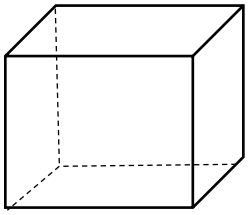

Figure 1. Cube

Cube characteristics: has 6 sides of the surface, has 12 ribs, has 8 corner points, has 12 diagonal fields, has 4 diagonal chambers, has 6 diagonal fields, has sides with a square shape, has the same long ribs, has a long field diagonal, has the same diagonal length of space, has a diagonal field with a long square shape.

Beam

A beam is a type of three-dimensional space geometry that is limited by two squares has four rectangles and is perpendicular. Examples of concrete objects such as block shapes in everyday life are pencil cases, lunch boxes, and wardrobes.

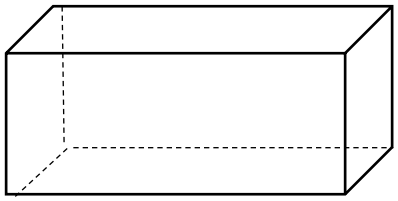

Figure 2. Beam

Characteristics: There are 6 side planes, there are 12 ribs (4 long ribs, 4 wide ribs, and 4 high ribs), there are corner points, there are 12 diagonal planes, there are 4 diagonal spaces, there are 6 diagonal planes, there are square and rectangular side beams, the diagonal length of the beam in the plane and the opposite side are the same size, there is a diagonal of the beam space of equal length, there is a diagonal plane that is rectangular.

Prism

A prism is a type of three-dimensional space geometry bounded by a congruent side of the base and side of the roof. Prisms are divided into three types: triangular prisms, pentagonal prisms, and hexagonal prisms. Examples of concrete objects that have the shape of a prism in everyday life are tents, brown wrappers, and rooftops.

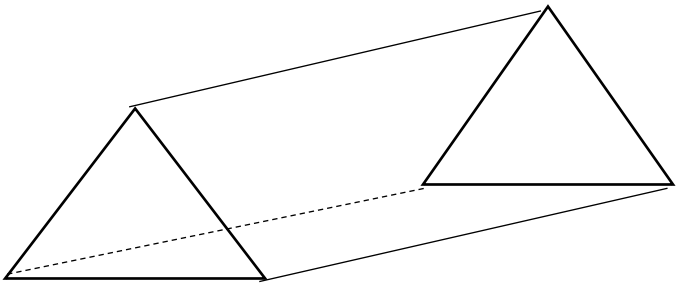

Figure 3. Triangular prism

Features of the prism: there are two corner points, there are 3 ribs, there are congruent or wake-shaped pedestals and roofs, there are side sides of the yeng having a rectangular shape, there are diagonal fields on the same side of the length, there are upright ribs, but there are also those that are not upright.

Pyramid

A pyramid is a type of three-dimensional space geometry that is limited by the plane of a multifaceted base and has a peak point. Pyramids are divided into several types, namely, triangular pyramids, quadrangular pyramids, pentagonal pyramids, and hexagonal pyramids. Examples of concrete objects that have a pyramid shape are Rubik's pyramids, Egyptian pyramids, and temples.

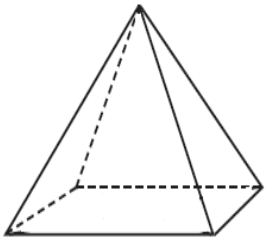

Figure 4. Pyramid

The characteristics of the pyramid: there are square-shaped pedestals, there are 5 side fields, there are 5 corner points, there are 8 ribs.

Concept Learning Strategy Build Curved Side Space

Teaching material to build curved side spaces in elementary schools should direct students to investigate and use ideas about relationships related to the geometric properties of curved side spaces. Through this learning, students are expected to be able to visualize and compare positions in spatial geometry, so that students can understand the material taught. Teaching space geometry material to students should be directed into activities that are more directed at the nature of building space itself than the explanation of simple concepts. Learning curved side space geometry can also be more easily conveyed to students by using models and supporting props. The use of these models and teaching aids teachers should use models that allow students to explore various properties of the building so that it is expected that students can group the geometry of space based on the nature of the building and the name of the building. In addition, teachers can also provide problems or case studies and solve them by discussion to better understand the concept of building space and practice their thinking skills. Based on research by Sudrajat et al. (2023), problem-solving learning can be done through case study discussions.

Types and features of waking up curved side space

Understanding the geometry of curved side space is to build space that has curved sides. The curved side is the side that forms the curve of the curve. Build a curved side space that has a blanket or plane surface, and types of space geometry such as; tubes, balls, as well as cones.

Cone

A cone is a geometry of space bounded by the plane of the base which has a circle shape and some sides have the shape of a circle slice called a cone blanket. The cone has only one corner point and one rib, and there are a total of two sides of the base that are circular and the side side envelops the circumference to the corner point. Examples of concrete objects such as cones in everyday life are cappings, birthday hats, *ice cream cones,* and serving lids.

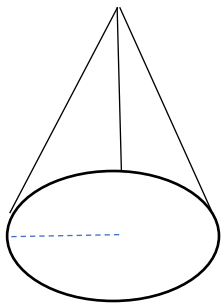

Figure 5. Cone

Cone features: there are two side fields, there is one curve rib, and there is one corner point as the peak point.

Tube

The tube is a geometric space bounded by the base and the top side is circular, while the vertical side plane of the tube forms a curve called the tube blanket. The distance between the side of the base and the side of the lid is called the height of the tube. Examples of concrete objects such as tubes in everyday life are milk cans, drums, and glasses.

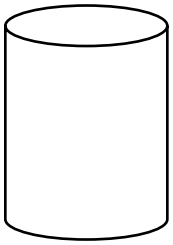

Figure 6. Tube

Tube Characteristics: there are three sides (two circles and one side of a rectangular blanket), there are two curved ribs, and there is a base and roof that has a circular shape, and does not have a corner point.

Ball

A sphere is a three-dimensional space bounded by a curved side. The sides of the plane on the sphere are equidistant at the center point. The ball has no ribs and corner points but has a curved side plane as a divider for the chamber. Examples of concrete differences in objects such as balls in everyday life are basketball, *volleyball*, and globe.

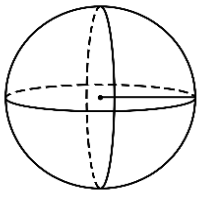

Figure 7. Ball

Characteristics: there is one curved side plane, there is one center point, there is a radius and diameter, there are no ribs, there is a surface area and volume, and there are radii that have the same length and infinity.

Learning Media for Space Geometry in Elementary Schools

Media concrete objects as props

Teaching media is media that is used to explain and provide an overview related to the concept of mathematics learning (Sholehah *et al*, 2022). Another effort that can be made to facilitate the understanding of elementary students in recognizing various spatial geometry, both flat and curved sides, is to use concrete objects. This method is also referred to as the demonstration method, where teachers are required to use a medium (Hariati *et al.*, 2022). Elementary students generally can think abstractly so they need real objects to be able to understand directly. It is expected that by using concrete objects students can recognize and understand the difference from building the space. The use of teaching aids builds space to increase the motivation and enthusiasm of learning students and attract their interest and concentration to pay attention to learning (Djuwita, 2015). The use of concrete media is intended so that teachers are helped in explaining and explaining material using concrete space-building props, then student learning outcomes are expected to increase. Teachers can demonstrate props in the form of concrete objects such as milk boxes, chocolate blocks, bottles, cans, tissue boxes, and others.

Figure 8. Examples of concrete bodies of space geometry

The use of concrete object media can be started by the way the teacher provides an image or material in the form of building space so that students are interested in thinking, then after students see the building of space in the form of concrete objects they can distinguish it well. Teachers can also approach by involving students to analyze how the object represents how to build space. Learners can mention, for example, block-shaped tissue boxes, tubular cans, and so on. Students can also understand the different types of building space. Students can also be assigned to look for objects around them that have a shape like the building of the space in

question. The teacher in presenting the material of building space using concrete objects only serves as a facilitator to encourage students to think and understand the types, characteristics, and differences of building space. Teachers can also direct students to discuss with their friends to better understand the material to build the space.

The use of concrete objects also has disadvantages and advantages. One of the disadvantages of using this prop is the limitation of goods. The items that can be used as props are only those that can be brought in class. Large items cannot be used as simple props, so teachers can also modify them by displaying items as concrete props through pictures. The teacher can make PowerPoint slides or just print his drawings. Large items such as cabinets, tents, vessels, and so on. This activity is also intended so that students have an image of the object, even if only through image media. One of the advantages of concrete media is that students become more understanding and can imagine various forms of building space, characteristics, and functions. Teachers must be able to modify it according to the conditions, and needs of students to want to learn and immediately understand the material to build this space. The final activity of the use of concrete objects is to conclude the types of space buildings, their characteristics, and their use in everyday life.

Powerpoint learning media

Along with the times and globalization, the use of electronic media is indeed very relevant to use. The use of electronic media is one of them in the field of elementary school education. The use of electronic-based media has various forms and can also attract the attention of students. Technology is indeed developed to improve the quality of student learning. PowerPoint learning media is a form of presenting images, audio, video, and so on. The use of PowerPoint can ease the burden on teachers to demonstrate an object. In this space-building material, teachers who want to demonstrate objects do not need to bring these objects, but only display the images through PowerPoint media.

The problem is that the use of PowerPoint media has not been mastered by all teachers. Some teachers do not even understand and feel the significant impact of using PowerPoint (Pramestika 2020). PowerPoint media can overcome the problem of student boredom, and make it easier for students to understand mathematical material, especially building space, and so on. Teachers in making PowerPoint can be in the form of animated images to attract students' interest in learning. Teachers can also display learning videos, songs, materials, and original images through PowerPoint media. This media has a variety of menu choices that are complete,

supportive, and diverse (Mardi *et al.*, 2013). This PowerPoint media if developed will greatly affect the interest and learning outcomes of mathematics students. Media like this can also be modified to create a quiz to ice-breaking activity.

Every learning media must have disadvantages and advantages, as well as the use of PowerPoint media. The advantages of this media in learning activities: (1) Make it easier for students to understand the material, especially spatial geometry material; (2) Help relieve teachers in explaining building space material; (3) Flexible and easy to use; (4) Attract and increase the concentration of students during the lesson.

This PowerPoint media also has some shortcomings when used or applied in a lesson. The disadvantages of this media are: (1) If there are too many animations, it is feared that it will make the focus of students' attention and not follow the focus of learning, especially building space material; (2) Teachers need a long time and preparation in preparing material through *power point* media; (3) Slide color selection, use that is too close, lack of lighting, use that is too long will damage the students' sense of vision; (4) The use of this media if it is not focused on learning will deviate from the learning objectives; (5) This media depends on the use of electricity, if the electricity fails, the material for building space through this media also cannot be displayed.

Space-building net props

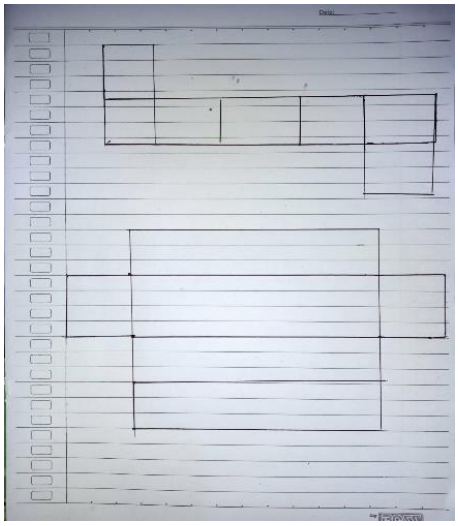

Figure 9. Cube webs and blocks

The application of learning methods in the classroom can be modified through the use of teaching aids to increase learning enthusiasm and concentration of student learning. The

definition of teaching aids is a tool or model of objects made to channel various learning materials in the form of media that can be seen and touched with the aim that the material taught is understood by students. The use of concrete props that have been modified is spatial geometry net props. Nets are modifications of a game that are applied to help students understand in recognize the form of building space (Farid & Halimatussa'diah, 2023). These nets should be made as attractive as possible so that they are easily understood by learners. These nets can be made from colored paper as well as plain paper. Teachers can demonstrate the shape of the nets or can involve learners in creating them.

CONCLUSION

Based on the results of research related to spatial geometry learning strategies in elementary school students, it can be concluded that teachers must teach basic concepts to students first by relating them to concrete objects in the real world. Teachers can develop innovative and fun teaching strategies and ways so that students can be enthusiastic in understanding the subject matter. The application of media and learning tools that support concrete objects is needed so that students know how spatial geometry material when applied in real life. Students are expected to be able to know the application of spatial geometry in the concept of everyday life reality.

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