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Stimulating Early Children's Knowledge about Shape Using the Geometry Board

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Abstract

This study aims to describe the use of learning media products in the form of geometric boards to develop children's cognitive abilities aged 4-5 years. Using the geometric board as media, children can easily recognize geometric shapes such as triangles, rectangles, circles, semicircles, rectangles, and parallelograms. This type of research uses an approach with a descriptive analysis model. The data analysis stage uses the Miles and Huberman model, including compaction, data presentation, and concluding. In this study, the the researcher chose to conduct research in kindergarten. The informants observed were children aged between 4 to

5 years who were in early childhood education and their parents. To check the validity of the data, using the triangulation technique. The results of the study found that using the geometry board was very helpful for parents in introducing geometry to their children. The media is made of simple materials that are easy to find, so it is not difficult to make. Children also become more interested in learning and are willing to learn various shapes of objects.

Keywords: early children, geometry, shape

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan tentang pemanfaatan produk media pembelajaran berupa papan geometri untuk mengembangkan kemampuan kognitif anak usia 4-5 tahun. Manfaat dari penggunaan media papan geometri ini agar anak dapat mengenal bentuk-bentuk geometri seperti bentuk segitiga, segi empat, lingkaran, setengah lingkaran, persegi panjang, dan jajaran genjang. Jenis penelitian ini menggunakan pendekatan kualitatif dengan model analisis deskriptif. Tahap analisis data menggunakan model Miles dan Huberman yang meliputi pemadatan data, penyajian data, dan penarikan kesimpulan. dalam penelitian ini peneliti memilih untuk melakukan penelitian di taman kanak-kanak. Informan yang diamati adalah anak-anak berusia antara 4 sampai 5 tahun yang berada dalam masa pendidikan anak usia dini serta orang tuanya. Untuk mengecek keabsahan data, peneliti menggunakan teknik triangulasi. Hasil penelitian menemukan bahwa penggunaan papan geometri sangat membantu orang tua dalam mengenalkan geometri kepada anak-anak. Media terbuat dari bahan-bahan sederhana yang mudah ditemukan sehingga tidak sulit pembuatannya.anak-anak juga menjadi lebih tertarik belajar dan memiliki kemauan untuk mempelajari ragam bentuk benda.

Kata kunci: anak usia dini, geometri, bentuk

A. Introduction

The children's perception begins as soon as they are born. By the time they were 18 months old, they had started to be able to see the difference between the objects they saw. For example, young children can see a table's shape differently from a ball's shape. He can also distinguish the shape of cats and other animals. In that stage, they can perceive forms based on what they perceive with their senses.

However, there are some problems in the stage of recognizing the shape. Children can sometimes see that the forms of two objects are identical but cannot pronounce their names. They can also show the differences between the figures but still can't accurately identify them.[1]

On the other side, children also need a basic concept of space to work adequately in their daily lives. Like adults, young children sometimes begin to develop basic spatial concepts, including the ideas they construct about

[1] Douglas H Clements and Sudha Swaminathan, "Young Children's Concepts of Shape," *Journal for Research in Mathematics Education* 30, no. 2 (1999): 192–212, https://doi.org/https://doi.org/10.2307/749610.

places, relative position, symmetry, and direction. It shows that some spatial ideas can form the perceptual system of humans, young children, or infants. They can tell the differences between near and far when they try to reach for a toy hanging directly above their head or a ball under the table. They can also further develop these abilities while walking. They are also aware of the environment and the surface on which they walk and create an idea of space and its environment wherever they roam. They also begin to use words to describe a location and direction.

Although the spatial ideas they construct can be helpful, children still have a lot to learn and need an adult to help them move. Therefore, early childhood teachers and parents can try to stimulate their ability to develop what children already understand about space. Teachers and parents can help young children build ideas about the spaces they see daily. Of course, this process involves using language and various representations and examples so children can understand spatial concepts.

Understanding the concept of space can help individuals in adulthood develop their plans in making plans about the shape of an object or the design of space. The ability to cope with this need is also known as spatial cognition. Spatial cognition refers to any behavior or activity of an organism that involves space or location with the assumption that this behavior utilizes brain functions.

Spatial cognition, according to Clements, includes all modes of personal knowledge about a subject space, such as perception, thinking, reasoning, and judgment.[2] Shepard and Cooper stated their views by using the term spatial thinking. Spatial thinking is an essential human ability that contributes to mathematical knowledge. It is a process that is distinct from verbal reasoning.[3] Both spatial cognition and spatial thinking contribute to children's skills to solve mathematic problems.

Geometry education can contribute to the growth of children's mathematical competence and stimulate other cognitive abilities, including IQ.[4] Child cognitive ability has to be continuously developed and stimulated from an early age.[5] For this reason, basic knowledge of geometry is needed

[2] Daniel Ness and Stephen J. Farenga, *Knowledge under Construction: The Importance of Play in Developing Children's Spatial and Geometric Thinking* (Lanham, Maryland: Rowman & Littlefield Publishers, 2007).
[3] Roger N. Shepard and Lynn A. Cooper, *Mental Images And Their Transformations* (Cambridge: MIT Press, 1982).
[4] Douglas H. Clements and Julie Sarama, "Early Childhood Teacher Education: The Case of Geometry," *Journal of Mathematics Teacher Education* 14 (2011): 133–148, https://doi.org/https://doi.org/10.1007/s10857-011-9173-0.
[5] M. Fadlillah and Ratna Pangastuti, "Parenting Style to Support the Cognitive Development of Early Childhood," *Jurnal Iqra': Kajian Ilmu Pendidikan* 7, no. 1 (2022): 156–63, https://doi.org/https://doi.org/10.25217/ji.v7i1.1614.

for children. Geometry is found in everyday life. Mastery of geometry can help children in the problem-solving process.

Geometry is used in everyday life. Geometry can encourage higher-order thinking. Besides developing logical thinking skills, geometry is also effective in helping solve problems in many branches of mathematics that children may need in the future.

Learning geometry in the early years can be significant because it can be consistent with the way young children move their bodies. Especially in early childhood, geometry and spatial reasoning form the basis of many learning mathematics and other subjects. Although our knowledge of children's geometric and spatial thinking is not as extensive as their numerical thinking, it has grown substantially. Teachers can use it as one of the foundations for curriculum development and teaching..

According to Clements, young children have the essential ability to build a spatial framework that might be more effective if developed again in classroom learning.[6] According to Piaget (in Salkind, 2009: 326) cognitive development of children aged 0-2 years is at the sensorimotor stage, where babies understand the world through physical and tangible actions against external stimuli. Behavior develops from simple reflexes through several steps to a set of organized schemes. Children aged 2-7 years are in the preoperational stage, where children in this stage are still thinking symbolic. Symbolic thinking enables children to make arrangements of words and pictures that describe an object so that it is associated with the delivery of learning.

Teachers and parents can do Geometry learning for early childhood by involving various media. One of them is the board. To overcome the problem of introducing geometry in class, a teacher makes mixed learning media in the form of a geometry board. This media is a simple board medium that aims to increase children's understanding of shapes and spaces. According to Sriningsih, a geometric board can be used to stimulate children's cognitive development, especially in recognizing geometric shapes, recognizing numbers, identifying colors, practicing fine and gross motor skills, and nurturing children's social and emotional states.[7]

B. Method

The approach used in this research is a qualitative approach using a descriptive model. The research procedures include (1) Doing a literature

[6] Douglas H Clements, "Teaching and Learning Geometry," in *A Research Companion to Principles and Standards for School Mathematics*, ed. Jeremy Kilpatrick, W. Gary Martin, and Deborah Schifter (Reston, Virginia: National Council of Teachers of Mathematics, 2003).
[7] Nining Sriningsih, *Pembelajaran Matematika Terpadu Untuk Anak Usia Dini* (Bandung: Pustaka Sebelas, 2008).

review; (2) Determining the research theme; and (3) carrying out field research. The data collection techniques in this study consisted of interviews and observations. The data analysis phase uses the Miles and Huberman model, including data condensation, data display, and concluding. In this study, the researchers chose to conduct research in kindergarten. The observed informants are children aged between 4 to 5 years who are in the early childhood education period and their parents. To check the validity of the data, the researcher used the triangulation technique.

C. Result and Discussion

Based on the data analysis of the research conducted, we found that the geometric board media with the main ingredients in its manufacture uses simple materials that we can find easily, such as wood, used cardboard, colored paper, and others. Parents show various shapes of objects such as squares, circles, triangles, and squares using examples of colored paper that have been formed. Each model represents different types of flat shapes and spatial shapes. Examples of building spaces made of paper of various colors with a 3-dimensional folding technique.

The tools and materials needed to make this media include:

a) masking tape
b) double-sided tape
c) white marker
d) scissors
e) ruler
f) origami papers
g) cardboard
h) cardboard, wood, or cork

In making geometric boards, parents involve children. Each child has the opportunity to help prepare materials and assemble them under the direction of their parents. As for how to make a geometric board, among others, as follows:

a) Cut the wood/cork/cardboard into squares
b) The surface of the wood/cork/cardboard is covered again with black cardboard using double-sided tape
c) Cut the cardboard according to various shapes, such as circles, triangles, semicircles, parallelograms, rectangles, and small rectangles
d) Next, cut the origami paper according to the shape of a circle, triangle, half-circle, parallelogram, square, and rectangle

e) Cut the double-sided tape and stick it on the back of the cardboard, which has the shape of a circle, triangle, semi-circle, parallelogram, rectangle, and square
f) Cut the tape and paste it onto the origami paper pasted on the surface of the wood/cardboard, adjusting to the shape of the origami paper.
g) On the back of a small cardboard box in the form of a circle, triangle, semi-circle, trapezoid, rectangle, rectangle by giving it a piece of double-sided tape and sticking it on a wooden surface/cardboard wrapped with black cardboard
h) Next, use a white marker to give a name under each shape that is affixed to the surface of the wood/cardboard/cork.
i) On the board's edge, double-sided tape as a decoration or border
j) To add three-dimensional shapes, make various shapes from cork and then paste them on origami paper and cardboard, which are already in the form of circles, triangles, semicircles, trapezoids, squares, and rectangles.

When parents introduce various shapes, in front of them, there are also several objects in the form of circles, circles, squares, cubes, and triangles. The objects used as examples include flower vases, balls, plates, and books. Parents can also add other things to set more benchmarks.

Interview results from interviews and observations show that using geometric boards as a medium in introducing geometry can optimize children's development in identifying shapes and shapes. Children can name geometric shapes such as triangles, parallelograms, semicircles, circles, and rectangles. Children are also able to hold scissors and can cut geometric shapes well. They can also paste the results of geometric shapes on boards with the same condition and location.

Image 1. Children string boards and stick geometric shapes

Based on the results of observations, it was found that several factors were supporting factors for implementing geometry boards for geometry learning. Supporting elements are located in the implementation of learning

for children aged 4-5 years, including 1) very high enthusiasm of children in participating in learning activities through geometric board media and 2) the activeness of educators in directing children during the activity.

Sriningsih explained that children could learn geometric shapes by recognizing shapes related to concrete objects.[8] According to Lestari K.W., adults can introduce the knowledge of mathematics to children from an early age (birth to 6 years). In children under three, mathematical concepts are discovered every day through their playing experiences.[9] In the practice of learning geometry mentioned above, the children are in the age range above three years. It means they already need a further introduction to mathematical concepts, although the scope of the discussion is still narrow. If previously, at the age of 3 years, they only recognized shapes and forms of space through the objects they saw and touched without any explanation, they need a description of the conditions of things at this age.

Based on the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 146 of 2014 concerning National Standards for Early Childhood Education, the cognitive development of children aged 4-5 years in recognizing shapes includes the ability to point to geometric shapes (triangles, squares, circles), and be able to classify shapes in the same group.[10]

Based on the observations, we also found that the parents used realia media for geometry learning. Realia media are concrete objects or natural objects that surround our daily lives. Realia media does not have to be in the classroom, but the thing can be anything that is seen directly by the child.[11] Realia media are objects used as teaching aids, both inside and outside the classroom. Through realia media or real media, children can more easily understand things directly shown to children in the learning process by providing a direct experience.[12]

The characteristics of realia media are original objects that are still intact, operable, alive, in their actual size, and can be recognized as their original form. Natural things are used, such as plants, fruit, flowers, etc. So that students easily remember what they learn because they have

[8] Sriningsih.
[9] Lestari KW, *Konsep Matematika Untuk Anak Usia Dini* (Direktorat Pembinaan PAUD & Direktorat Jenderal PAUD Nonformal dan Informal Kementerian Pendidikan Nasional, 2011).
[10] Indonesia's Ministry of Education and Culture, "Regulation of Indonesia's Minister of Education and Culture about the 2013 Curriculum of Early Childhood Education," Pub. L. No. 146 (2014).
[11] M. Japar, *Media Dan Teknologi Pembelajaran PPKN* (Surabaya: Jakad Media Publishing, 2019).
[12] Fani Karmita Sari and Lidia Oktamarina, "Pengaruh Media Realia Terhadap Pemahaman Geometri Anak Usia 5-6 Tahun Di TK Nurul Iman Beringin Makmur I Kabupaten Musi Rawas Utara Tahun 2021," *Jurnal Ilmiah Potensia* 7, no. 1 (2022): 11–22, https://doi.org/https://doi.org/10.33369/jip.7.1.11-22.

experienced it directly and interacted with the media. Learning experiences like this will make children better understand the material presented.[13]

By using realia media, the use of geometric boards becomes more optimal. It is because children not only recognize shapes from deliberately made examples but also see and touch objects directly in everyday life, which represent various shapes and forms of space.

Unfortunately, the use of geometric boards does not directly develop the principle of media realia. To make the geometric board feel more natural, teachers and parents can use a variety of small, original objects to stick to the surface. That way, the examples of shapes on the geometry board look more authentic.

As Apriyansyah stated, the use of realia media is the use of natural objects that are presented directly for children's learning resources, and this is in increasing children's naturalist intelligence. The use of realia media is a strategy for assessing four aspects of naturalist intelligence, namely recognizing flora, fauna, and natural objects, distinguishing flora, fauna, and natural objects, revealing flora, fauna, and natural things, and making categories of flora, fauna and natural objects.[14] He also said that realia media could indirectly help teachers stimulate children's development; namely, children can use their five senses directly to use their physical motor aspects.

The application of naturalist intelligence stimulation has not been seen in the use of geometric boards. At the same time, we can find geometric shapes in many types of native objects and natural objects, such as fruits, plants, and so on. It can be a part of the suggestions in further developing the geometry board.

D. Conclusion

Based on the discussion above, we can conclude that the media plays a vital role in absorbing knowledge in early childhood, including knowledge of geometry. By carrying out activities using the appropriate steps and skills in using the geometry board, children can develop cognitive abilities, including skills in recognizing various shapes and designs. Children become easier to recognize and remember different shapes and mention their names. Using a geometry board, they can also more easily distinguish shapes based on their characteristics.

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[13] Ai Suminar and Alfian Ashshidiqi, "Mengembangkan Kecerdasan Logika Matematika Dengan Menggunakan Media Realia Pada Anak Usia 5-6 Tahun Di TK Negeri Pembina," *Jurnal Jendela Bunda Program Studi PG-PAUD Universitas Muhammadiyah Cirebon* 7, no. 2 (2019): 22–34.

[14] Chandra Apriyansyah, "Peningkatan Kecerdasan Naturalis Melalui Penggunaan Media Realia," *Jurnal Ilmiah Kajian Ilmu Anak Dan Media Informasi PAUD* 3, no. 1 (2018): 13–26, https://doi.org/https://doi.org/10.33061/ad.v3i1.2069.

But there are still shortcomings. Evaluation needs to be done so that it can be considered in the development of geometric boards. Using geometric panels does not directly develop the principle of media realia. o make the geometric board feel more natural, teachers and parents can use a variety of small, original objects to stick to the surface. That way, the examples of shapes on the geometry board look more authentic.

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