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# Efforts to Improve Early Childhood Cognitive Abilities Through Virtual Realty (VR) Based Learning Media

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***Abstract***

*The development of technology in this millennial era is giving a new face to education. Issues were found from the observations, including: 1) a lack of technological facilities in schools, 2) a decline in children's cognitive abilities. Based on the issues presented in the background, this study aims to use virtual reality learning media to enhance the cognitive abilities of early childhood children. Classroom Action Research (CAR), the method used in this research. To collect data, the researchers used the following data collection methods: 1) Observation, gathering information from the observation of the research subjects. 2) Documentation, collecting several images of activities as part of the research. The author uses quantitative and qualitative analysis methods to collect data. This research found that the use of virtual reality-based media as a learning tool can enhance the cognitive abilities of young children. It can be seen from the first cycle of research that the classical average score of the children reached 54%. Meanwhile, in the second cycle, it increased to 82%. The target for the classical achievement set by the researcher was an average of 78%. Thus, in the second cycle, the classical average score of the children was achieved in accordance with the researcher's target. The use of virtual reality (VR) media has brought new innovations to the world of early childhood education, although currently only a few schools are using it for learning.*

## INTRODUCTION

Technological developments in this millennial era provide a new face to education. Technology has experienced rapid development in the last few decades, bringing significant changes to various aspects of life, including in the field of education (Siahaya et al., 2024). Virtual Reality (VR) is a technology that is increasingly popular and is considered to have great potential

for education. With the help of virtual reality (VR) technology, children can interact with computer-simulated worlds in the same way as they would in the real world. Virtual reality (VR) has become a powerful tool in education and has changed the conventional way of learning and opened up new opportunities for immersive learning experiences (Sulaiman Kurdi, 2021).

From the results of the observations, several problems were found, including: 1) lack of technological facilities in schools, 2) decreased cognitive abilities of children. Some children don't know the colors, long and small, big and small, and patterns of the letters a, b, c, and d (Anggita et al., 2022). The factor causing the decline in the cognitive aspect of PAUD is the lack of variety in a teacher's learning methods or styles, so it tends to be monotonous and boring (Rizkia, 2020). Cognitive delays are caused by a lack of cognitive stimulation, which impacts other aspects of development later in life (Pangarti & Yaswinda, 2023).There is still a lack of awareness and utilization regarding the use of VR technology in enhancing the learning experience(Utami et al., 2024). Lack of digital tools is one of the causes of this problem.Teachers rely more on textbooks/textbooks or teaching materials prepared by other teachers (Monoarfa, 2021).

Teachers' mastery of the use of technology in creating new learning media and students' interest in learning are related and have an influence on cognitive abilities(Fransiska et al., 2024). An innovative solution to improve the cognitive abilities of young children through the use of virtual reality (VR).By using VR as a learning tool, virtual reality can be a new innovation in early childhood education (Orsicha et al., 2024). *VR Box*allowing students to engage in a more in-depth and interactive learning experience (Karim & Assrani, 2024).

Cognitive abilities can develop children's thinking power to train children's knowledge so that they are well stimulated and can achieve expectations (Syahreni et al., 2024). VR-based learning media can make children interested in learning. With VR, children can engage in immersive and interactive learning environments, participating in activities that are difficult or impossible to do in the real world (Alfath, 2024). Since the use of technology, education has offered fantastic things, where learning is not limited by space and time, even corners (Sudana et al., 2018). Therefore, VR is very interesting for young children to use because it can create an interactive learning environment.

The advantages of VR according to (Auri Pramesti et al., 2022) This is considered more effective because virtual reality (VR) can make the world look like the real thing and can be done anywhere and anytime without being limited to space and time while on the network.This technology has a drawback: limited use of VR, which means that many people cannot use it at the same time (Siregar & Theresia, 2023). To minimize these weaknesses, several ways can be done, including: 1) introducing teachers to how to use virtual realty media first. 2) use VR devices according to needs.3) ensure children are in a safe environment when using Virtual Realty.

Cognitive abilities such as grouping, recognizing numbers, geometric shapes, recognizing the concepts of letters, numbers and time, and recognizing sizes all depend on cognitive development (Berliana et al., 2024). Learning about Mathematics concepts in early childhood can be done through playing activities in daily life. This is in accordance with the principles of early childhood learning, namely learning while playing and playing while learning (Wahyu Widiana et al., 2023). In this research the author focuses on several indicators, 1) recognizing geometric shapes. 2) mention the names of geometric shapes. 3) calculate many geometric shapes. 4) group geometric shapes according to their colors.

Based on the problems in the background, this research aims to use learning media*virtual realty*to improve the cognitive abilities of young children. Benefits of this researchcan use technology-based media that can be useful for early childhood.

## LITERATURE REVIEW

This research is strengthened by previous research. This research succeeded in producing a product in the form of virtual reality as a learning medium (Darojat et al., 2022) (Wulandari et al., 2022)VR will support increasing students' cognitive abilities (Choirin Attalina et al., 2024) states that virtual reality (VR) media can improve student understanding, become easier to use, and make lessons more interesting.When VR is used in conjunction with guided inquiry learning, students' cognitive abilities will improve (Kasih & Pd, 2024). The validation results of material experts and media experts show that VR-based materials and media are very suitable and suitable for use in learning (Dewi, 2020). 3D VR learning media increases student interest and learning outcomes (Wiradhika et al., 2021).Utilizing virtual reality (VR) and augmented reality (AR) technology produces significant learning activities that provide students with a comfortable learning experience (Suryaman et al., 2023). The difference between this research and previous research is that this research uses virtual reality media as a learning medium to improve the cognitive abilities of young children. Where virtual realty media is still rarely used in early childhood learning, this is a new innovation in the world of early childhood education. Children are more interested in technology-based learning in the current era of digital technology. Researchers chose virtual realty media because it fits the criteria for active and interactive early childhood so that in virtual realty-based learning children can develop their cognitive abilities without being hindered by space and time.

## METHODS

In this research, the method used was PTK (Classroom Action Research). The CAR framework developed by Kemmis and McTanggart to make this research easier to understand and well connected was used (Putri & Harfiani, 2024). The research (Arliana et al., 2024) technique uses 4 stages, namely: a) planning, namely a description prepared to contain plans that will be addressed to children, b) implementation is the stage of activities that have been planned by the researcher. Implementation is the implementation of the planning stage. c) observation is an activity of analyzing implementation activities that are taking place. Observations are carried out to determine the development of research objects during research activities, so as to obtain research results. d) reflection, which is the stage of expressing all the data that has been obtained and comparing it with existing theory. The reflection activity aims to develop a plan that will be implemented next. There were 12 class B1 students at Dewi Sartika Sumberarum Kindergarten who were involved in this research, 5 boys and 7 girls.

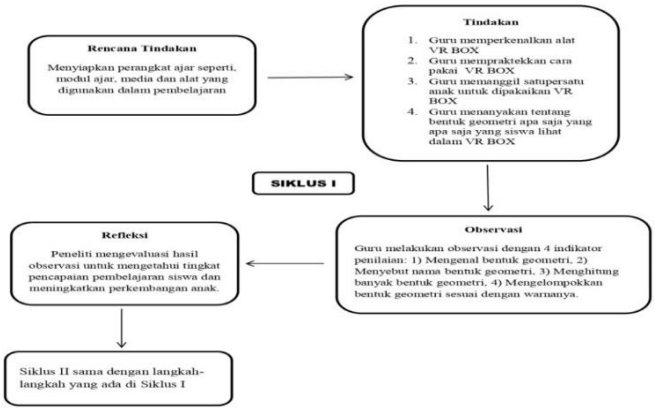


**Figure 1.** PTK Research Cycle

Next, researchers collect data. as follows: 1) Observation, collecting information from observations of research subjects. 2) Documentation, collecting several pictures of activities as part of the research. The data analysis used by the author is qualitative and quantitative.Qualitative research is a constructivist research approach, which assumes that reality has multiple dimensions, is interactive, and is an exchange of social experiences that are interpreted by each individual.(Haki et al., 2024).Quantitative research generally uses descriptive and inferential statistics for data analysis (Candra Susanto et al., 2024).The data is then analyzed again using the following formula: $P = \frac{F}{N} X100\%$.Note: P = percentage of maximum ability F = score obtained N = total score (Pradana et al., 2024). And the assessment observations used for child development are not yet developing (BB), starting to develop (MB), developing according to expectations (BSH), developing very well (BSB).

## RESULTS AND DISCUSSION

The first cycle of planning includes creating teaching tools such as instructional modules, tools and materials, as well as media that will be used in learning which aims to increase the intelligence of early childhood through the use of virtual reality (VR) based media. In this learning, the tools and media used are VR Box, cellphone (HP), laptop, and YouTube videos. Meanwhile, the materials used are paper with geometric shapes and geometric blocks.

In action, the first thing to do is introduce the instruments, materials and media that will be used during learning. The teacher explains how to use the VR Box tool properly and correctly. After that, the teacher practiced how to use the VR Box tool with the children. The children take turns being helped to use the VR Box device. With curiosity, children started to watch the videos in the VR Box. During the learning process, there were children who did not want to use the VR Box because they felt unfamiliar with the tool. The teacher tries to persuade and give children confidence so they want to try using the VR Box tool. After all the children have finished taking turns watching the video with the VR Box tool, the teacher asks what geometric shapes are in the video, then how many geometric shapes the children see. From this question, there were several children who were still confused about differentiating between various geometric shapes, and there were also several children who could not count the number of geometric shapes in the video.

Next, the teacher observes the learning outcomes by viewing videos of geometric shapes using the VR Box tool and evaluating children's cognitive development through Virtual Realty (VR) based learning media. The indicators used by researchers are 1) recognizing geometric shapes, 2) saying the names of geometric shapes, 3) counting the number of geometric shapes, 4) grouping geometric shapes according to their colors. The child development assessments used are Not Yet Developing (BB), Starting to Develop (MB), Developing According to Expectations(BSH), Very Well Developed (BSB).

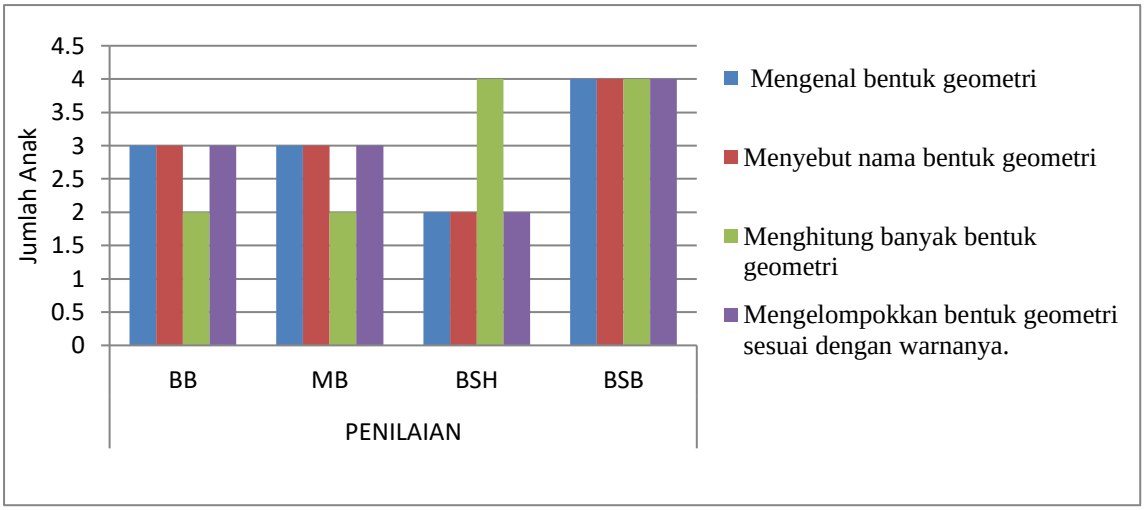


**Figure 2.** Cycle 1 Assessment Results Based on the research graphic images,

The results in figure 2 showed that 3 children were able to recognize geometric shapes, 3 children were not yet developing, 3 children were starting to develop, 2 children were developing as expected, 4 children were developing very well. able to name geometric shapes. 3 children have not yet developed, 3 children are starting to develop, 2 children are developing as expected, 4 children are developing very well. able to count many geometric shapes, 2 children have not yet developed, 2 children are starting to develop, 4 children are developing as expected, 4 children are developing very well. Able to group geometric shapes according to their colors. 3 children have not yet developed, 3 children are starting to develop, 2 children are developing as expected, 4 children are developing very well

**Table 1.** Results of Cycle I Research

| NO | INDICATOR | EVALUATION | | | | PRESENTATION | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | BB | MB | BSH | BSB | BB | MB | BSH | BSB |
| **1** | Get to know geometric shapes | 3 | 3 | 2 | 4 | 25% | 25% | 17% | 33% |
| **2** | Name geometric shapes | 3 | 3 | 2 | 4 | 25% | 25% | 17% | 33% |
| **3** | Counting many geometric shapes | 2 | 2 | 4 | 4 | 17% | 17% | 33% | 33% |
| **4** | Group geometric shapes according to their colors. | 3 | 3 | 2 | 4 | 25% | 25% | 17% | 33% |
| | **AVERAGE** | | | | | 23% | 23% | 21% | 33% |

From the cycle I assessment table 1, children's ability to improve cognitive abilities through media-based learning*virtual realty*(VR) children have not yet developed reaching 23%, starting to develop reaching 23%, developing according to expectations 21%, and developing very well reaching 33%. This happens because children are still not used to using tools*VR Box*in learning and there are only a few children who know the tools*VR Box*. In this assessment, children's achievements have not yet developed and are starting to develop, reaching 46%, while children are developing according to expectations and developing very well, reaching 54%. The classical value of a child's achievement can be found by adding up the child's development from developing according to expectations and developing very well. From this research, the average classical score of children reached 54%, while the average classical achievement of researchers was 78%. From this explanation, children's cognitive abilities have not reached the target in cycle I.

Because the children's cognitive abilities had not reached the target in cycle I, the researchers continued the research in cycle II. Cycle II follows the same steps as Cycle I. However, Cycle II begins planning to determine learning activities, prepare the tools, materials and media used, and determine learning objectives.

The next step is action. The teacher introduces the tools, materials and media that will be used. Then, show the children how to use the tools*VR Box*. Then, the teacher calls the children one by one to be put on the equipment*VR Box*. After it is used and the learning video is played, the teacher asks questions about what geometric shapes are in the video and how many geometric shapes are in the video. In this lesson, all the children seemed willing to try using the tools*VR Box*and starting to get used to the tool.

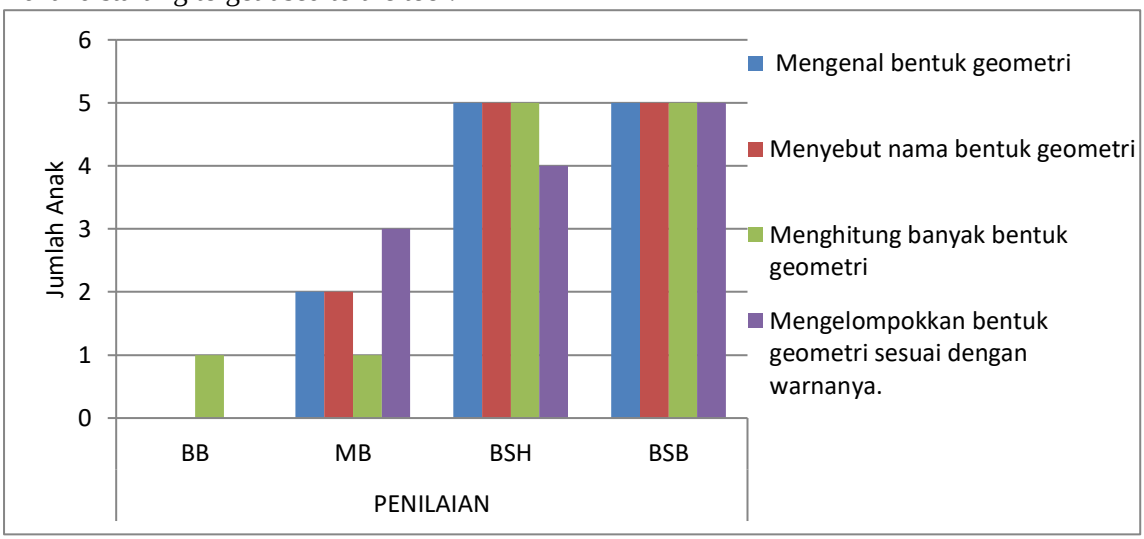


**Figure 3.** Results of Cycle II Assessment

From the second cycle of research, the results showed that children were able to recognize geometric shapes, 0 children began to develop, 2 children began to develop, 5 children developed as expected, and 5 children developed very well. Children were able to name geometric shapes, 0 children had not yet developed, 2 children were starting to develop, 5 children were developing as expected, and 5 children were developing very well. Children are able to count many geometric shapes, 1 child has not yet developed, 1 child is starting to develop, 5 children are developing as expected, and 5 children are developing very well. Children are able to group geometric shapes according to their colors, 0 children have not yet developed, 3 children are starting to develop, 4 children are developing as expected, and 5 children are developing very well.

**Table 2.** Results of Cycle II Research

| NO | INDICATOR | EVALUATION | | | | PRESENTATION | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | BB | MB | BSH | BSB | BB | MB | BSH | BSB |
| **1** | Get to know geometric shapes | 0 | 2 | 5 | 5 | 0% | 17% | 42% | 42% |
| **2** | Name geometric shapes | 0 | 2 | 5 | 5 | 0% | 17% | 42% | 42% |
| **3** | Counting many geometric shapes | 1 | 1 | 5 | 5 | 8% | 8% | 42% | 42% |
| **4** | Group geometric shapes according to their colors. | 0 | 3 | 4 | 5 | 0% | 25% | 33% | 42% |
| | **AVERAGE** | | | | | 2% | 17% | 40% | 42% |

The results of the second cycle of research show that virtual reality (VR)-based learning media can improve the cognitive abilities of young children, where children have not yet

developed and are starting to develop, reaching an average of 19%. Meanwhile, children develop according to expectations and develop very well, reaching an average of 82%. Based on these results, it shows that the research cycle II has reached an average of 78% for researchers. The second cycle of research ended because the aim of improving the cognitive abilities of early childhood through virtual reality (VR) based learning media had been achieved and fulfilled.

**Figure 4.** Learning activities through media-based (VR)

The image in figure 4 shows efforts to improve the cognitive abilities of young children through the use of virtual reality (VR). Before learning begins the teacher first explains the VR Box tool that will be used. The teacher uses the VR Box tool to the children in turn. During the learning process, the teacher observes and asks several questions related to the learning topic. It can be seen that the children are very happy and enthusiastic in participating in learning from start to finish.

According to the results of Classroom Action Research (PTK), which was carried out in two cycles, the second cycle showed that utilizing Virtual Realty (VR)-based learning media to improve the cognitive abilities of young children showed improvement. Thus, the results of the first cycle of research reached an average of 54%, and the results of the second cycle increased to 82%. In cycle I there were problems that children were not familiar with the VR Box tool and were not used to using the VR Box tool in learning. With these obstacles, teachers try to convince children to try and give examples of its use repeatedly. So, during the second cycle, children began to get used to and become more enthusiastic about the lessons, which enabled them to achieve the goal of improving the cognitive abilities of early childhood through Virtual Realty (VR) based learning media. This increase occurred because children felt curious about the tools used after hearing stories from their friends who had the courage to use the VR Box tool. VR Box makes children more focused on learning because VR Box makes children only focus on watching videos without being able to see the surrounding environment. Learning using the VR Box can be done interactively, children can follow what they see in the video.

## CONCLUSION

The conclusion of this research is that the use of virtual realty learning media can improve the cognitive abilities of young children. In the first cycle of research, the average classical score of children reached 54%, and in the second cycle of research, the score increased to 82%, meeting the researcher's classical achievement target of 78%. Thus, the average classical score of children was achieved in the second cycle of research. The use of virtual reality (VR) media has created a new innovation in the early childhood education environment, which in fact is still very few who use it for learning.

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