The Effect of Concrete Media on The Learning Outcomes of Spatial Mathematics For Blind Students in Phase C at SLB A YKAB Surakarta

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Abstract: *Education is the key to developing and realising life values, and it is a factor that motivates children to learn and develop their potential. However, many visually impaired students, such as those at SLB A YKAB Surakarta, still experience difficulties in receiving information related to spatial geometry. Therefore, concrete objects are an appropriate learning medium to use in teaching spatial geometry. This study aims to demonstrate the effect of using concrete objects as a learning medium on the mathematics learning outcomes of visually impaired students in phase C at SLB A YKAB Surakarta. This study uses a quantitative method with a one-group pretest posttest design. The sampling technique used was purposive sampling with a sample size of 6 visually impaired students in phase C. The data collection techniques used in this study were pretest and posttest. Validity testing used expert validity and Aiken's V formula, while reliability testing used the KR 20 (Kuder Richardson 20) technique. Data analysis was conducted using non-parametric statistics through the Wilcoxon Matched Pairs Test. The study's results indicate that the use of concrete media significantly influences the improvement of mathematics learning outcomes in spatial geometry for visually impaired students in phase C at SLB A YKAB Surakarta, as evidenced by the Asymp. Sig. (2-tailed) value of 0.026 < 0.05.*

Keywords: *Visually Impaired, Concrete Media, Learning Outcomes, Mathematic*

Abstrak: Pendidikan sebagai cara untuk mengembangkan dan mewujudkan nilai-nilai kehidupan serta menjadi faktor anak untuk ingin belajar dan mengembangkan potensinya. Namun, masih banyak peserta didik tunanetra salah satunya di SLB A YKAB Surakarta yang mengalami kesulitan dalam menerima informasi terkait materi bangun ruang. Oleh karena itu, media benda konkret adalah media pembelajaran yang tepat digunakan pada materi pembelajaran bangun ruang. Maka dari itu, penelitian ini bertujuan untuk untuk menunjukan bagaimana pengaruh penggunaan media benda konkret terhadap hasil belajar matematika materi bangun ruang peserta didik tunanetra fase C di SLB A YKAB Surakarta. Penelitian ini menggunakan metode kuantitatif dengan bentuk one group pretest-posttest design. Teknik sampling yang digunakan teknik purposive sampling dengan jumlah sampel sebanyak 6 peserta didik tunanetra fase C. Teknik pengumpulan data yang digunakan dalam penelitian ini, yaitu prestest dan posttest. Pengujian validitas menggunakan validitas dari para ahli dan formula Aiken's V sedangkan uji reliabilitasnya menggunakan teknik KR 20 (Kuder Richardson 20). Teknik analisis datanya menggunakan statistic non parametrik melalui Wilcoxon Matched Pairs Test. Hasil penelitian menunjukkan bahwa penggunaan media konkret berpengaruh secara signifikan dalam meningkatkan hasil belajar matematika bangun ruang peserta didik tunanetra fase C di SLB A YKAB Surakarta karena nilai Asymp. Sig. (2- tailed) 0.026 < 0.05.

Kata kunci: Tunanetra, Media Konkret, Hasil Belajar, Matematika

1. INTRODUCTION

Education is one way to develop and realize life values and is one of the factors that motivate children to learn and develop their potential. Therefore, the state divides the education system in Indonesia into three models, namely integrated education, inclusive education, and segregated education. Integrated education is an integrated education system that brings together students with special needs and regular students in the same class and school (Latifah, 2020). Meanwhile, the development of the integrated education model is inclusive education, while segregated education is an education system that places children with special needs with the same disabilities in one school (Winarsih, 2017). The segregated education model can be seen in the establishment of Special Education Units or Special Schools tailored to specific disabilities.

One of the Special Schools in Surakarta City is SLB A YKAB Surakarta for students with visual impairments (blind). According to Yudhiastuti and Azizah (2019) and Badiah (2016), visually impaired students are individuals with partial or total visual impairment, causing them to experience difficulties and limitations in performing daily activities, including learning activities. Currently, the number of visually impaired people in Indonesia is around 4 million, or 1.5% of the total population of Indonesia (Ramli & Gatra, 2023). Therefore, adjustments are needed in both the learning methods and learning media used to make it easier for visually impaired students to receive and understand learning information so that the obstacles they experience can be handled properly.

Based on observations conducted at SLB A YKAB Surakarta, it was found that students in that class had difficulty in receiving information related to the ongoing spatial geometry material, such as inaccuracy in identifying or distinguishing spatial shapes. This was due to the teaching method used by the teacher, which was lecture and question and answer. In addition, there were weaknesses in the learning media used by the teacher. Therefore, concrete objects are one type of learning media that can be used in spatial geometry lessons to improve learning outcomes so that visually impaired students gain concrete experience in learning.

Based on the background description and observations, it can be concluded that concrete learning media can be a solution for handling students who experience difficulties and a decline in learning outcomes in mathematics learning in spatial geometry material. Therefore, the research question in this study is whether there is an effect of the use of concrete objects on the mathematics learning outcomes of spatial geometry material for phase C visually impaired students at SLB A YKAB Surakarta. Meanwhile, the purpose of this study is to show how the use of concrete media affects the mathematics learning outcomes of phase C visually impaired students at SLB A YKAB Surakarta in the subject of spatial figures.

2. METHOD

This study used a quantitative approach in the form of a pre-experimental design. The research design was a one-group pretest-posttest design. The independent variable in this study was concrete objects, while the dependent variable was learning outcomes in solid geometry. This research was conducted at SLB A YKAB Surakarta from December 2024 to July 2025 with a sample of 6 visually impaired students in phase C. The sampling technique used purposive sampling, while the data collection technique used a test consisting of 10 questions. The scoring system consisted of scores from 0 to 1, with a minimum final score of 0 and a maximum of 10. The formula for calculating the final score was as follows:

$$Score = \frac{Obtained\ Score}{Maximum\ Score} \times 100$$

The categorization of academic proficiency assessment according to Azwar (2016) in this study is as follows:

Table 1. Assessment Categorization

Score Range	category
X ≤ 24.995	Very Low
< X ≤ 41.665	Low
< X ≤ 58.335	Moderate
< X ≤ 75.005	High
> 75.005	Very High

The validity test technique used content validity testing with the help of an instrument grid, which was then validated by experts and Aiken's V formula, while the reliability test used the KR 20 technique. Meanwhile, the data analysis technique used was non-parametric statistics through the Wilcoxon

Matched Pairs Test. The research process consisted of the preparation, implementation, and completion stages.

3. RESULT AND DISCUSSION

This study was conducted in three stages. The first stage was preparation, including administrative preparation, instrument development, and instrument validity testing. The second stage included a pretest, four treatments, and a posttest. The final stage was data collection, processing, and analysis.

Pretest data is the initial data on students' learning outcomes in solid geometry obtained from initial measurements. The pretest data values can be seen in the following table:

Table 2. Pretest Score Data

No	Initial	Pretest	Category description
1.	JR	20	Very Low
2.	NN	10	Very Low
3.	YA	20	Very Low
4.	SA	10	Very Low
5.	NA	30	Very Low
6.	Kl	60	High
Total		**150**	
Avarege		**25**	

Based on Table 2, it shows that in the pretest, there were five students who obtained very low scores, namely 10, 20, and 30, and one student who obtained a high score of 60.

The treatment was conducted four times, with each session lasting 40 minutes in the classroom. Details of the treatment activities are as follows:

1. In the first treatment, students analyzed concrete media in the form of cubes, then the researcher explained the media and the elements of cube shapes.
2. The second treatment consisted of a review of the material on cube shapes and questions related to the elements of cube shapes.
3. The third treatment shifted to new material, namely rectangular prisms, using concrete media as learning media. The researcher also asked a few questions related to the elements of rectangular prisms.
4. In the fourth treatment, the researcher again provided concrete media in the form of cubes and rectangular prisms and repeated the material on cubes and rectangular prisms.

Posttest data was obtained from students' scores after treatment to measure the effect of concrete media on the spatial learning outcomes of visually impaired students. The following are the posttest data obtained:

Table 3. Posttest Score Data

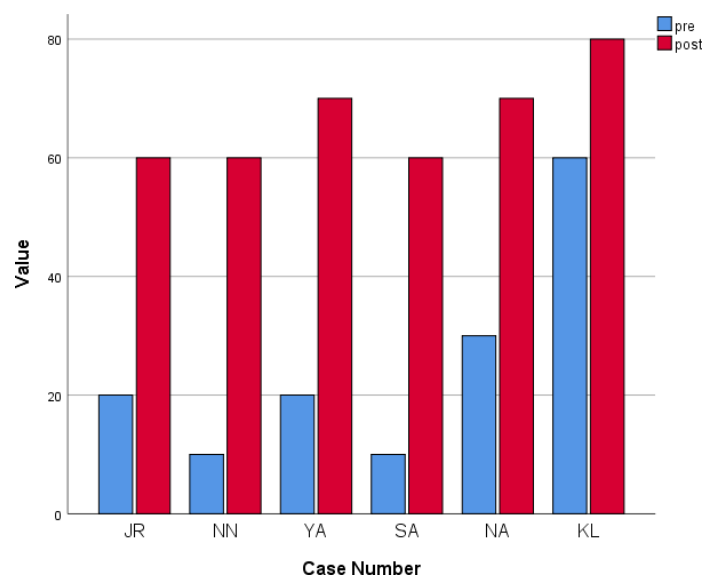| No	Initial	Pretest	Category description
1.	JR	60	High
2.	NN	60	High
3.	YA	70	High
4.	SA	60	High
5.	NA	70	High
6.	KL	80	Very High
Total		**400**	
Avarege		**66,67**	

Table 3 shows the post-test results with an average score of 66.67. In this data, there was one student who obtained the highest score of 80, two students who obtained a score of 70, and three students with a score of 60.

The results of the pretest and posttest data were compared to determine whether or not the use of concrete media had an effect on the spatial mathematics learning outcomes of visually impaired students in phase C at SLB A YKAB Surakarta. The following table compares the pretest and posttest data.

Table 4. Comparison of Pretest and Posttest Scores

No	Initials	*Pretest*	*Posttest*	**Difference**
1.	JR	20	60	40
2.	NN	10	60	50
3.	YA	20	70	50
4.	SA	10	60	50
5.	NA	30	70	40
6.	KL	60	80	20

Table 4.8 above shows the difference in student scores before and after treatment using concrete media. The following is a histogram comparing pretest and posttest scores:

Hypothesis testing was conducted using nonparametric testing with the Wilcoxon Sign Rank Test to prove whether the effect that arose before or after the subjects were given treatment using concrete media on improving the spatial mathematics learning outcomes of visually impaired students in phase C at SLB A YKAB Surakarta was acceptable or not.

Table 5. Results of Wilcoxon Sign Rank Test Data Analysis Calculations

		N	Mean Rank	Sum of Ranks
post – pre	Negative Ranks	0a	.00	.00
	Positive Ranks	6b	3.50	21.00
	Ties	0c		
	Total	6		

a. post < pre
b. post > pre
c. post = pre

Based on Table 5, it shows that the negative rank of the pretest and posttest treatment results is 0, both in the N value, Mean Rank, and Sum of Rank, indicating that there is no decrease from the pretest score to the posttest score. In the positive rank, N indicates that all samples experienced an increase from the pretest score to the posttest score. The average result (mean rank) increased by 3.50, while the positive ranking result (sum of ranks) was 21.00. The Ties score was 0, which means that there were no identical scores between the pretest and posttest results.

Table 6. Test Statistics Results

Z	-2.232[b]
Asymp. Sig. (2-tailed)	.026

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks

The basis for decision making in the Wilcoxon Sign Rank Test is:
1. If the Asymp. Sig. (2-tailed) value is < 0.05, then H0 is rejected and Ha is accepted;
2. If the Asymp. Sig. (2-tailed) value is ≥ 0.05, then H0 is accepted and Ha is rejected.

Table 6 shows that the Wilcoxon Sign Rank Test (Z) value is -2.232 and the Asymp. Sig (2-tailed) value is 0.026. Because the Asymp. Sig. (2-tailed) value is smaller than the significance level, or 0.026 < 0.05, H0 is rejected and Ha is accepted.

Based on this data, it can be concluded that the use of concrete media has a significant effect in improving the spatial mathematics learning outcomes of phase C visually impaired students at SLB A YKAB Surakarta. The factor that makes concrete media effective in influencing learning outcomes is the use of concrete media in teaching spatial mathematics to visually impaired students in phase C at SLB A YKAB Surakarta. Based on this data, it can be concluded that the use of concrete media has a significant effect on improving the spatial mathematics learning outcomes of visually impaired students in phase C at SLB A YKAB Surakarta. Factors that enable concrete media to influence the spatial mathematics learning outcomes of visually impaired students include the fact that visually impaired individuals rely on haptic memory (touch) to construct mental representations of spatial shapes. Concrete media provide tactile experiences for visually impaired students to compensate for the lack of visual input. This is in line with Pogrund & Fazzi (2021), who showed that exploring the edges, angles, and surfaces of cubes through 3D media increased the accuracy of spatial representation by 37% higher than audio explanations.

The provision of treatment in the form of concrete media also made students pay more attention and made it easier for them to understand the material on spatial elements that was presented. This opinion is reinforced by the results of Subagya's (2018) research, which states that visually impaired students find it easier to understand learning material by using real or concrete objects that can be touched, such as spatial models. Based on the posttest data, visually impaired students obtained high scores, indicating that concrete media are appropriate to use because students can directly touch and analyze the shape of a spatial figure directly and tangibly. These results are in line with research by Sukani (2025) and Karisma & Ahdhianto (2023), which explains that the use of concrete media improves the learning outcomes of visually impaired students in mathematics learningarap mengirimkan naskah anda melalui form untuk direview sebagai attachments e-mail. Ketika anda mengirimkan dokumen naskah versi awal dalam format Word.doc satu kolom, termasuk gambar dan tabel.

4. CONCLUSION

Based on the data and discussion, it can be concluded that concrete media affect the spatial mathematics learning outcomes of phase C visually impaired students at SLB A YKAB Surakarta. This is because concrete media can provide tactile experiences for visually impaired students to replace the role of visual stimuli in students. The theoretical implications arising from this study are that it can be

used as reference material for theoretical studies for further research and development in the field of education. Meanwhile, the practical implications of this research can be used by educators in learning activities to improve the mathematics learning outcomes of phase C visually impaired students by preparing concrete media that are in accordance with the shape of the space to be studied and always providing guidance to students about the elements of space. This study also suggests that teachers use concrete media so that students can participate more actively in learning and be more confident in analyzing the shapes of spatial figures using concrete media. Parents can also use concrete media as learning tools for their children at home. This study is also expected to serve as a reference and source of information for further research by other researchers.

5. ACKNOWLEDGMENTS

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