

Improving Students' Dyscalculia Numeracy Ability Using Learning Media Colored Bead Montessori

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Abstract: This study aims to investigate the effects of *colored bead Montessori* learning media to students' numeral thinking skills none of the elementary schools (SD) in Padang, Indonesia. This study used a quantitative method with a single-subject research approach, the research data was taken from a student with *dyscalculia* through fifteen direct lessons using *colored bead Montessori* learning media. Data were analyzed by using visual graphical analysis tool descriptively were analyzed descriptively using visual graphical analysis tools. The results of this study showed that the use of *colored bead Montessori* learning media based on the analysis can actually improve the numeracy skills of students with *dyscalculia* in learning. This improvement is proved by, at first the students' scores were 2, 4, 4, 4, this was the value before the researcher used the media. Furthermore, after the researcher did seven times direct treatment, it was found that the students' scores increased to 10, 13, 15, 18, 20, 20, 20, even students were able to obtain self-evaluation scores with numbers 20, 20, 20, 20. The results of this study proved that the use of *colored bead Montessori* media has been able to improve the numeracy skills of students in learning. Referring to the results of this research, *colored bead Montessori* can be used as an alternative media in learning numeracy skills of students with *dyscalculia* none of the elementary schools..

Keywords: Media; coloured bead Montessori; numeracy; mathematics.

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INTRODUCTION

Media is inseparable from the teaching and learning process in order to achieve educational goals. Media is anything that can be used as a medium in the communication process that can be seen, heard, and read so that the message from the sender to the recipient of the message can be understood and used to make the interaction between teachers and students' effective in the learning process (Engkizar et al., n.d.; Munna et al., 2021; Practice & 2016, 2016; Putra et al., 2020). The that learning media are used in order to make students understand the content of learning easily and must be carefully prepared in order to make the learning process done effectively (Afifah et al., 2019; Agusti et al., 2018).

In the context of learning, the use of learning media must be adjusted to the material to be taught, especially in mathematics (Agusti et al., 2018; Syafril et al., 2020; Yuniyanto et al., 2021). Mathematics has abstract objects that make it difficult for some students to understand concepts so that it affecting their performance (Asmaranti & Andayani, 2018; Azmidar et al., n.d.; Godino et al., 2010). An alternative tool id needed in the form of

Based on the results of VOSviewer's analysis of abstract and title studies on learning methods of dyslexic children that there are still few who have just examined this theme, which can be seen in the picture above that this study was last studied in 2016. The research that the author refers to here is research that has been published in international journals indexed by Scopus. The results of the analysis found that dyslexia children have an effect on the child's individual development (individual), children's social relationships (relationship). This research is still little studied in Indonesia, especially research on learning dyslexic children using Montessori colored bead media.

Based on some research results and expert opinions above, it turns out that learning media greatly affects the results of students, especially in aspects of mathematics subjects. However, based on research results Iftayani et al., (2018); Sa'adati, (2015); Suharmini, (2005) students have problems in learning, especially in aspects of mathematics subjects such as lack of understanding of symbols, values placement, wrong processes, calculations, and writing that is difficult to read. Students who experience problems in the aspects of learning mathematics can be classified as students with special needs (Jarmita, 2015). These students are often identified as dyscalculia (Mulyadi, 2010; Suryani, 2010).

Based on the previous study, it was found that a female student in grade IV. This student is familiar with numbers and can count quickly, can count objects, sort numbers appropriately, show precisely large and small comparisons, and can write and read unit numbers up to tens and the ability to determine values placement and low numeric values. One of the interventions that can be used in the value placement aspect is the use of instructional media. The learning media in question must be attractive and tailored to the needs of students.

Previous research on learning media, especially the use of learning media for dyscalculic students, includes research (Handarini & Hasan, 2019; Patricia et al., 2021; Reafani et al., n.d.; Widodo et al., 2021; Yovelina et al., n.d.). However, this research examines the use of learning media in addition and subtraction aspects. This research specifically discusses the use of colored bead Montessori media in learning the place value of numbers in mathematics. The placement of values consists of units, tens, hundreds, thousands, and so on (Aprinastuti et al., n.d.; Azhari et al., 2022; Purwaningrum et al., 2022). This is what differentiates this research from previous research.

METHOD

This research was conducted in the Elementary School (SD) 06 Piai, Pauh District, and Padang City, Indonesia. To obtain research data, the researcher used quantitative methods with a single subject research approach. According to Horner et al., (2005); Ledford et al., (2009) Single subject research is a quantitative experimental research approach to prove the existence of a causal relationship between the dependent variable and the independent variable. The research data was taken from a student with dyscalculia through fifteen direct lessons using *colored bead Montessori* learning media. All data that the researchers obtained were analyzed descriptively using visual graphical analysis tools, this method of analysis is one of the techniques for analyzing *single subject research*. (Sunanto et al., 2006; Zhan & et al, 2001). The data analyzed in this study were divided into two, namely analysis in conditions and analysis between conditions.

RESULT AND DISCUSSION

The state of the scores of students before using *colored bead Montessori* media, this condition was carried out by the participants for four sessions with an achievement score of 4. Both results of the analysis of students' scores after the researcher of the learning intervention used *colored bead Montessori* media, this condition was carried out by the participants for seven sessions by showing an increasing in the score from 10 to the maximum achievement score of 20. This shows that *colored bead Montessori* learning media in learning can increase the ability of students in the aspect of determining the value placement of a number. This research is supported by research (Laski et al., 2016) who found that the success of students in the material value placement of a number using colored bead Montessori media. Third, the final results of the students' abilities without any media influence, this condition was carried out by the students for four sessions by showing a maximum achievement score of 20.

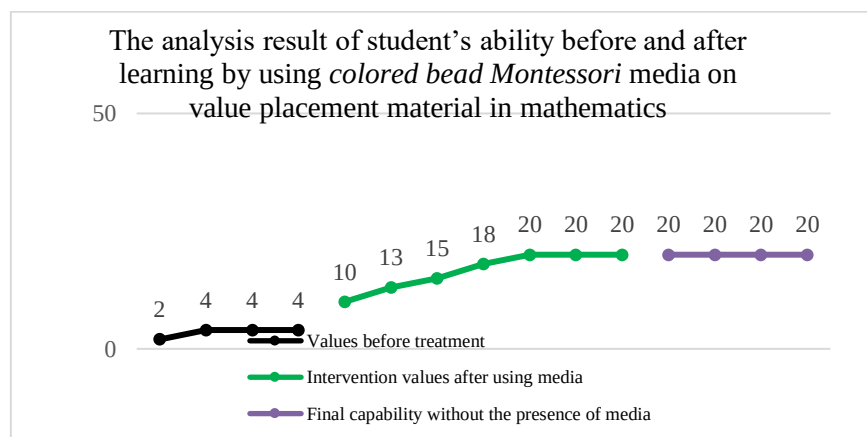


Figure 3. The Analysis Result Of Students' Ability Improvement Before and After Learning by Using Colored Bead Montessori on Number Value Placement in Mathematics.

Based on the results of the analysis above, it was found that the ability of students on the value material where a number increased in score significantly. Analysis in the conditions of this study by analyzing changes in one condition data on activities before treatment, after using *colored bead Montessori* media and the final ability of students after treatment was stopped (without any media influences). The components of the visual analysis in conditions consist of the length of the condition, the estimation of the directional trend, the trend of stability, the trend of the data trail, the level of stability and range, and the level of change.

First, the results of the calculation of activities before learning using *colored bead Montessori* media showed a positive score increase with a stability level of 0% which means unstable. The level of change has a range of 2 - 4 with a difference of +2 (improving). Second, the results of the calculation after the researcher learning intervention using *colored bead Montessori* media showed a significant increase in the score with a stability level of 14.29% which means it is not stable. The level of change has a range of 10 - 20 with a difference of +10 (improving). Third, the results of the calculation of the students' final ability without the influence of the media did not show any changes with a stability level of 100% meaning that it was stable. The level of change has a range of 20 - 20 with a 0 (stable).

margin. In general, the description of the components that the researcher means can be seen in table 1 below.

Table 1. The Results of The Analysis Before Treatment and After Learning by Using Colored Bead Montessori Media and the Final Conditions Without Any Treatment from the Media

No.	Component	Before Treatment	After using media	After the treatment was stopped
1	Long condition	4	7	4
2	Estimated trend direction	 (+)	 (+)	 (=)
3	Trend of stability	0% Unstable	14.29% Unstable	100% Stable
4	Trending data footprint	 (+)	 (+)	 (=)
5	Stability level and range	Variable 2 - 4	Variable 10 - 20	Stable 20 - 20
6	Change level	$4 - 2 = 2$ (+)	$20 - 10 = 10$ (+)	$20 - 20 = 0$ (=)

Analysis between conditions in this study is done by comparing one condition with another. The components of the visual analysis between conditions consisted of number of variables that were changed, changes in trend direction and their effects, changes in stability trends, changes in levels and percentage of overlap. First, the results of the analysis between conditions before treatment to conditions after treatment using *colored bead Montessori* media, it was found that changes in stability showed unstable to unstable with an overlap percentage of 0%. Second, the results of the analysis between conditions after learning to use *colored bead Montessori* media to the final ability condition without the influence of the media, it was found that changes in stability showed unstable to stable with an overlap percentage of 57.14%.

Table 2. The results of the analysis between conditions before treatment to conditions after treatment using *Colored Bead Montessori* media and conditions after learning using *Colored Bead Montessori* media to the final ability condition without any influence from the media

No.	Component	Between Conditions Before Treatment to Conditions After Using Media	Between Conditions After using the Media to the Final Capability State without the presence of a Media
1	Number of variables changed	1	1
2	Changes in trend direction and their effects	 (+)(+)	 (+)(=)
3	Change in trend stability	Unstable to unstable	Unstable to stable
4	Level Change	$10 - 4 = +6$	$20 - 10 = +10$
5	Overlap Percentage	$\frac{0}{7} \times 100\% = 0\%$	$\frac{4}{7} \times 100\% = 57,14\%$

Mathematics is an important part of science and is a field of study that will be found from elementary school to college. Mathematics is given to students therefore they are able to think logically, analyze, systematically, critically, creatively, and work together. However, it was found that there were still many students who experienced problems in learning, especially aspects of learning mathematics. Students who experience problems in learning mathematics are one type of students with dyscalculia which are often referred to as dyscalculia. The forms of errors that are often seen in students with dyscalculia are not understanding symbols and values placement, using wrong processes, counting errors, and writing that cannot be read (Mulyono, 2010).

For this reason, the efforts of teachers are expected to overcome these problems then among the efforts that can be made such as: teachers need to pay attention to principles in teaching (Damri et al., 2017; Yusnita et al., 2018; Kasmar et al., 2019). Then teachers must be able to provide guidance more for students who have problems in learning and teachers must be creative in preparing props or media that support learning so that students can more easily understand the material provided (Murniyetti et al. 2016; Agusti et al., 2018; Jarmita, 2015; Yeni, 2017; Iskandar et al., 2023; Rahmiati et al., 2023). Learning to count as meant in this research is the concept of the value placement of a number. The value placement is the value of a number consisting of ones, tens, hundreds, and so on (Subai'ah., 2014). Values placement are taught so that students are able to solve problems related to mentioning and writing number symbols, and complete arithmetic operations (Sari et al, 2019).

The results of this study clearly showed that the use of *colored bead Montessori* media can improve students' numeracy skills, especially in learning the value placement of a number. Because this *colored bead Montessori* media provides students with a visual and tactile experience that aims to strengthen the understanding of mathematical concepts concretely, learning can then create a learning environment that supports the development of numeracy skills better. The media used is like colored beads.

The results of this study are found that the use of instructional media has a significant correlation with the academic achievement of students, especially in the aspects of mathematics (Anggraini et al., 2015; Febrician et al., 2019; Handarini et al., 2019). Referring to the results of research supported by several previous studies, it is seen that increasing numeracy skills, especially in learning the value placement of a number, can be done using *colored bead Montessori* learning media. (Lillard, 2011; Putri et al., 2020). *Colored beads* are beads that are strung together with a specific color code according to the value placement of the number.

CONCLUSION

The importance of students' numeracy skills, especially in the value placement material is taught to avoid learning problems that persist. Because in mathematics learning, students who experience problems find it difficult to understand new material that requires mastery of previous material. One alternative that can be used is *colored bead* media. Based on the results of the research in this article, the use of *colored bead Montessori* learning media has succeeded in increasing numeracy skills, especially in learning the place value of a number for students with special need.

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