Utilization of Multiplication Board Learning Media to Improve Mathematics Learning Outcomes for Class 10 Students with Mental Retardation at SLB C Autism Negeri Kedungkandang

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Abstract

Learning mathematics is often a challenge for students at various levels of education, especially for mentally retarded students at SLB C Autism Negeri Kedungkandang. One topic that students often find difficult is multiplication. The cognitive limitations of students with intellectual disabilities make understanding abstract concepts such as multiplication more difficult, requiring more effective teaching methods. One innovation that can be implemented is the use of multiplication board learning media. This study aims to evaluate the effectiveness of the multiplication board in improving the mathematics learning outcomes of grade 10 students with intellectual disabilities. The methods used include observation, intervention, pretest and posttest, as well as interviews with teachers and students. The research results show that the use of a multiplication board can improve understanding of multiplication concepts, reduce errors in calculations, increase students' self-confidence, and encourage active involvement in the learning process. The use of visual aids is effective in helping mentally retarded students understand and master multiplication operations. Of a total of 6 students, the results showed significant improvement after implementing the multiplication board, with 4 students able to do multiplication independently and 2 other students requiring less help than before.

Keywords: Mental retardation; Instructional Media ; Mathematics ; Multiplication Board

1. Introduction

Learning mathematics is often a challenge for students at various levels of education (Ramadhan & Hamid, 2023) . One topic that students often find difficult is multiplication. Skills in multiplication are very important, not only in academic contexts but also in everyday life. Understanding and mastering multiplication becomes the basis for more complex mathematics topics in the future, such as division, fractions, and algebra (Afifah & Fitrianawati, 2021) . One way to overcome this difficulty is to implement innovative learning media, such as multiplication boards. The multiplication board is a visual tool designed to help students understand and memorize the multiplication tables more effectively. Through this board, students can see number patterns more clearly and gain a deeper understanding of the relationship between numbers in multiplication. Considering the importance of multiplication skills in various aspects of daily life and the continuation of mathematics learning, it is very important to find effective methods for teaching it (Kurniawati, 2022) . One innovation that can be implemented is the use of multiplication board learning media.

Multiplication is a basic mathematical operation that students must master from an early age. Unfortunately, many students have difficulty understanding the concept of multiplication, which impacts their learning outcomes. This difficulty is often caused by less interesting teaching methods and a lack of effective tools for learning. Apart from that, students tend to feel bored and unmotivated when they only learn through verbal explanations or textbooks. Learning media are tools that can facilitate the teaching and learning process. One media that can be used to improve students' understanding of multiplication is the multiplication board. A multiplication board is a visual tool that contains a multiplication table for the numbers 1 to 10 or more. By using a multiplication board, students can see patterns in multiplication and understand concepts more easily and with fun.

Mentally retarded students at SLB C Autism Negeri Kedungkandang face unique challenges in learning mathematics, especially in understanding abstract concepts such as multiplication (Armin & Purwati, 2021) . Their cognitive limitations often require more time, repetition, and visual aids to understand the material being taught. Therefore, the use of appropriate teaching methods and effective tools is very important to help them in the learning process. Multiplication is a basic mathematical operation that is very important to master, not only for advanced mathematics but also for everyday life, such as in calculating money, measuring, and solving problems. One learning medium that can help students understand multiplication is a multiplication board (Febrianingrum, 2022) .

The multiplication board provides a visual representation of the multiplication table, which can help students see patterns and relationships between numbers, making the concept of multiplication more concrete and easier to understand (Nafisah & Furnamasari, 2023) . The benefits of a multiplication board include helping to visualize patterns such as the distributive, commutative and associative properties of multiplication; provides enjoyable repetition; increasing student motivation through attractive visual media; and facilitate memorization through repeated practice. By using the multiplication board, it is hoped that the mathematics learning outcomes of grade 10 mentally retarded students at SLB C Autism Negeri Kedungkandang will increase. Clear visualization can improve understanding of concepts, reduce errors in calculations, increase student self-confidence, and increase active involvement in the learning process. In conclusion, the use of multiplication boards as a learning medium can have a positive impact on the mathematics learning outcomes of grade 10 students with intellectual disabilities at SLB C Autism Negeri Kedungkandang.

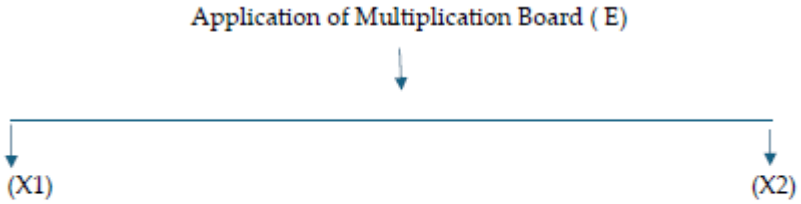
To understand the impact more, research or case studies can be conducted to measure the effectiveness of multiplication boards specifically in that context. Empirical data from test results, observations and interviews with teachers and students can provide a clearer picture of the impact of using multiplication boards in mathematics learning.

2. Method

The multiplication board provides a visual representation of the multiplication table, which can help students see patterns and relationships between numbers, making the concept of multiplication more concrete and easier to understand (Nafisah & Furnamasari, 2023) . The benefits of a multiplication board include helping to visualize patterns such as the distributive, commutative and associative properties of multiplication; provides enjoyable repetition; increasing student motivation through attractive visual media; and facilitate memorization through repeated practice. By using the multiplication board, it is hoped that the mathematics

learning outcomes of grade 10 mentally retarded students at SLB C Autism Negeri Kedungkandang will increase. Clear visualization can improve understanding of concepts, reduce errors in calculations, increase student self-confidence, and increase active involvement in the learning process. In conclusion, the use of multiplication boards as a learning medium can have a positive impact on the mathematics learning outcomes of grade 10 students with intellectual disabilities at SLB C Autism Negeri Kedungkandang.

To understand the impact more, research or case studies can be conducted to measure the effectiveness of multiplication boards specifically in that context. Empirical data from test results, observations and interviews with teachers and students can provide a clearer picture of the impact of using multiplication boards in mathematics learning. ability to calculate multiplication operations in mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang which is described as follows:



E : Application of the multiplication board
X1 : Pretest (before treatment)
X2 : Posttest (after treatment)

The results of observations and interviews were analyzed thematically to identify student responses to learning media and the challenges they faced. Quantitative data from performance tests is analyzed to calculate the percentage of success and increase in understanding. The combination of qualitative and quantitative analysis provides a comprehensive picture of the method's effectiveness.

3. Results and Discussion

3.1 Result

1. The ability to calculate multiplication operations in mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang before using the multiplication board

Data table for mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang

No	Student Code	Gender	Amount
1	FRL	Male	1
2	FRD	Male	1
3	AL	Male	1
4	D.N	Male	1
5	FQ	Male	1
6	RFL	Male	1
Total		-	**6**

Source: Grade 10 attendance of mentally retarded students at SLB C Autism Negeri Kedungkandang

This research data collection technique uses tests. This technique is used to obtain data about the multiplication ability of mentally retarded students before or after using the multiplication board. The planned test material for this research is simple multiplication calculation operations using a multiplication board. The form of the test is by answering 10 multiplication questions. The criteria for giving marks are 0 and 1. A score (0) is if the student is unable to answer the questions. Score (1) if the student is able to do the question correctly. So the maximum score is 10.

Meanwhile, the minimum score that a student can achieve is 0. In this study, researchers categorized them as 1) very capable, 2) capable, 3) quite capable, 4) less capable, 5) incapable. Thus, in this research the following categories can be obtained:

Table: Categorization of test result scores

No	Value Interval	Category
1	88-100	Very capable
2	66-79	Able to
3	56-65	Quite capable
4	41-55	Less able
5	≤ 41	Unable to

In drawing conclusions regarding this research, data analysis used quantitative descriptive analysis. This technique is used to describe the increase in the abilities of mentally retarded students either before or after implementing the multiplication board in the process of learning multiplication counting operations. This research aims to see the extent to which

the ability to calculate multiplication operations has increased in mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang. This research used 6 students. Measurement of the increase in the ability to calculate multiplication operations was carried out twice, namely a test before using the multiplication board in learning multiplication calculation operations to obtain an idea of the initial ability level of students with intellectual disabilities. Meanwhile, the second measurement was carried out after students were given instruction using a multiplication board in learning multiplication calculation operations.

The research data obtained is intended to answer the problems raised in this research. The analysis used on the research data obtained is processed using quantitative descriptive analysis, then presented in the form of tables and diagrams.

Table of initial test scores for the ability to calculate multiplication operations

No	Student code	Initial test scores
1.	FRL	1
2.	FRD	2
3.	AL	5
4.	D.N	6
5.	FQ	5
6.	RFL	4

Based on the table above, it shows the initial scores for the ability to calculate multiplication operations for the six mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang. Next, the score obtained is converted to a standard value of 100 using a predetermined formula. If the MSKS is connected, the results can be seen in the following calculation:

a. First student (initials FRL)

Students with the initials FRL get a total score of 1 out of 10 multiplication questions and after conversion they get a score of 10. Currently FRL students cannot complete the multiplication calculation operations as found in questions number 2,3,4,5,6,7,8, 9,10. FRL students were only able to complete the multiplication calculation operation on question number 1.

$$FS : \left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) \times 100$$

$$= \frac{1}{10} \times 100$$
$$= 10$$

b. Second student (initials FRD)

Students with the initials FRD get a total score of 2 out of 10 multiplication questions and after conversion they get a score of 20. Currently FRD students cannot complete the multiplication calculation operations as found in questions number 3,4,5,6,7,8,9, 10. FRD students were only able to solve questions number 1 and 2.

$$FS : \left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) X\ 100$$

$$= \frac{2}{10 \times 100}$$
$$= 20$$

c. Third student (initials AL)

Students with the initials AL received a total score of 5 out of 10 multiplication questions and after conversion they received a score of 50. Currently AL students cannot complete the multiplication calculation operations as found in questions number 6,7,8,9,10. AL students are only able to solve questions number 1-5.

$$FS : \left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) X\ 100$$

$$= \frac{5}{10 \times 100}$$
$$= 50$$

d. Fourth student (initial DN)

Students with the initials DN got a total score of 6 out of 10 multiplication questions and after conversion they got a score of 60. Currently DN students cannot complete the multiplication calculation operations as found in questions number 7, 8, 9, 10. DN students are able to solve questions 1-6 .

$$FS : \left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) X\ 100$$

$$= \frac{6}{10 \times 100}$$
$$= 60$$

e. Fifth student (initials FQ)

Students with the initials FQ got a total score of 5 out of 10 multiplication questions and after conversion they got a score of 50. Currently FQ students cannot complete the multiplication calculation operations as found in questions number 6,7,8,9,10. DN students are able to solve question 1 -5.

$$FS : \left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) X\ 100$$

$$= \frac{5}{10 \times 100}$$
$$= 50$$

f. Sixth student (initials RFL)

Students with the initials RFL got a total score of 4 out of 10 multiplication questions and after conversion they got a score of 40. Currently RFL students cannot complete the multiplication calculation operations as found in questions number 5, 6, 7, 8, 9, 10. DN students are able to solve questions 1-4.

$$FS : \left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) X\ 100$$

$$= \frac{4}{10 \times 100}$$
$$= 40$$

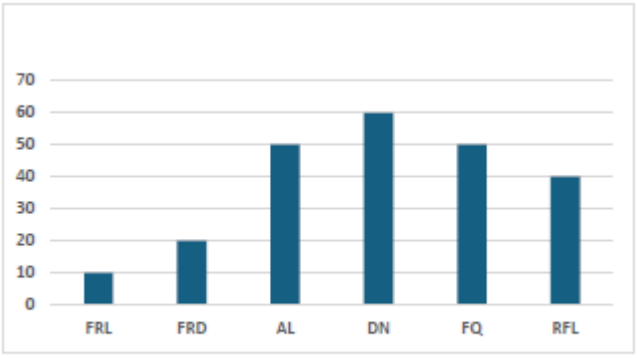
Based on the calculation results of the scores obtained by mentally retarded students in the initial test, the scores of the six mentally retarded students are outlined in the following table:

Table: categorization of the ability to calculate multiplication operations

No	Student code	Mark	Category
1	FRL	10	Unable
2	FRD	20	Unable
3	AL	50	Less fortunate
4	D.N	60	Capable
5	FQ	50	Less fortunate
6	RFL	40	Less fortunate

Based on the results of the analysis as presented in the table above, scores were obtained for the six mentally retarded students in class 10 SMALB before using the multiplication board. The results of this first test can show that how many Class 10 SMALB students are in the underprivileged and unable categories.

For more details, it will be visualized in the following graph:



Visualization graph of students' multiplication calculation ability scores mentally retarded class 10 SMALB at SLB C Autism Negeri Kedungkandang

2. The ability to calculate multiplication operations in mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang after using a multiplication board.

To determine the ability of mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang after using the multiplication board, this can be determined through a final test. The data on mentally retarded students in class 10 SMALB after using the multiplication board is further outlined in the following table:

Final test score table for the ability to calculate multiplication operations

No	Student code	Initial test scores
1.	FRL	3
2.	FRD	5
3.	AL	7
4.	D.N	9
5.	FQ	7
6.	RFL	6

calculate multiplication operations for the six mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang after using the multiplication board. Next, the score obtained is converted to a standard value of 100 using a predetermined formula. If the MSKS is connected, the results can be seen in the following calculation:

a. First student (initials FRL)

FRL students got a score of 3 out of 10 multiplication questions and after conversion they got a score of 30. After learning the multiplication operation using a multiplication board, currently FRL students cannot solve 7 questions, namely numbers 4, 5, 6, 7, 8, 9, 10 . FRL students succeeded in answering 3 questions correctly.

$$FS : \left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) X\ 100$$

$$= \frac{3}{10 \times 100}$$
$$= 30$$

b. Second student (initials FRD)

FRD students got a score of 5 out of 10 multiplication questions and after conversion they got a score of 50. After learning multiplication operations using a multiplication board, currently FRD students cannot solve 5 questions, namely numbers 6, 7, 8, 9, 10. FRD students succeeded in answering 5 questions correctly.

$$FS : \left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) X\ 100$$

$$= \frac{5}{10 \times 100}$$
$$= 50$$

c. Third student (initials AL)

AL students got a score of 7 out of 10 multiplication questions and after conversion they got a score of 70. After learning multiplication operations using a multiplication board, currently AL students cannot solve 7 questions, namely numbers 8,9,10. AL students managed to answer 7 questions correctly

$$FS : \left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) X\ 100$$

$$= \frac{7}{10 \times 100}$$
$$= 70$$

d. Fourth student (initials DN)

DN students got a score of 9 out of 10 multiplication questions and after conversion they got a score of 90. After learning the multiplication operation using a multiplication board, currently DN students were unable to solve 9 questions, namely number 10. DN students managed to answer 9 questions correctly.

FS : $\left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) \times 100$

$= \frac{9}{10 \times 100}$
$= 90$

e. Fifth student (initials FQ)

FQ students got a score of 7 out of 10 multiplication questions and after conversion they got a score of 70. After learning multiplication operations using a multiplication board, currently FQ students cannot solve 7 questions, namely numbers 8,9,10. FQ students managed to answer 7 questions correctly.

FS : $\left(\frac{\text{Score Obtained}}{\text{Maximum Score}}\right) \times 100$

$= \frac{7}{10 \times 100}$
$= 70$

f. Sixth pupil (initials (RFL)

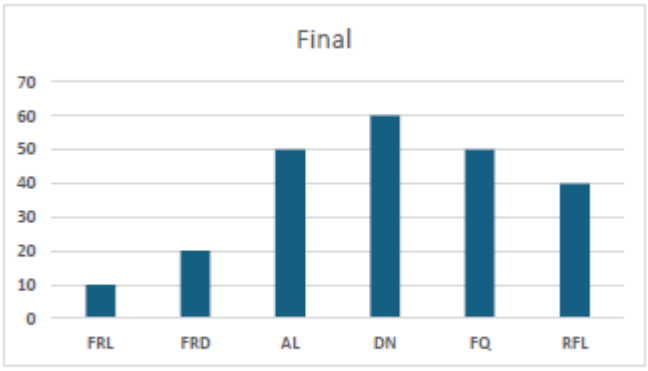
RFL students got a score of 6 out of 10 multiplication questions and after conversion they got a score of 60. After learning multiplication operations using a multiplication board, currently RFL students cannot solve 6 questions, namely numbers 7, 8, 9, 10. RFL students managed to answer 6 questions correctly.

Based on the calculation results of the scores obtained by mentally retarded students in the final test, the scores of the six mentally retarded students are outlined in the following table:

Table: categorization of the ability to calculate multiplication operations

No	Student code	Value	Category
1	FRL	30	Unable to
2	FRD	50	Less able
3	AL	70	Able to
4	DN	90	Very capable
5	FQ	70	Able to
6	RFL	60	Quite capable

Based on the results of the analysis as presented above, the value of the ability to complete the multiplication calculation operation was obtained for the six mentally retarded students in class 10 SMALB at SLB C Autis Negeri Kedungkandang after using the multiplication board, namely FRL and FRD students were still less capable, AL, FQ students were able, DN students were very capable. capable and RFL students are quite capable. For more details, it will be visualized in graphical form:



Visualization graph of students' multiplication calculation ability scores mentally retarded class 10 SMALB at SLB C Autism Negeri Kedungkandang.

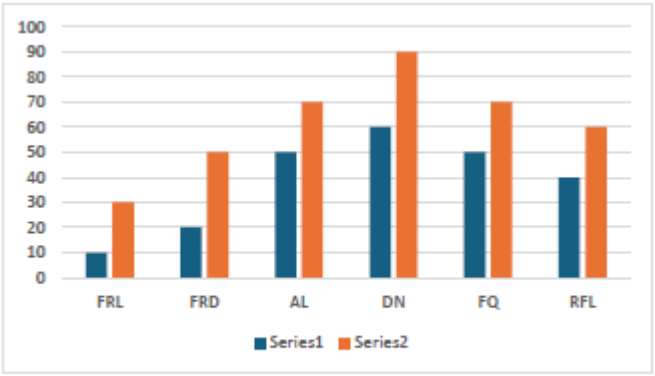
3. The ability to calculate multiplication operations in mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang before and after using the multiplication board.

Improving the ability to calculate multiplication operations in mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang can be achieved by comparing the value of the ability to calculate multiplication operations obtained between before and after using the multiplication board. The comparison of the value of the ability to calculate the multiplication operation between before and after using the multiplication board can be seen in the following table:

Comparison table of the capabilities of multiplication calculation operations

Student code	Value before	Value after	Category
FRL	10	30	Unable
FRD	20	50	Less fortunate
AL	50	70	Capable
D.N	60	90	Very capable
FQ	50	70	Capable
RFL	40	60	Quite capable

Based on the data above, it can be explained that in general and individually the ability to calculate multiplication operations among mentally retarded students has changed towards being more capable and there has been an increase in the ability to calculate multiplication operations among mentally retarded students in class 10 SMALB. For more details, it will be visualized in the following graph:



Visualization graph of students' multiplication calculation ability scores mentally retarded class 10 SMALB at SLB C Autism Negeri Kedungkandang.

Education for children with special needs, especially children with intellectual disabilities or what are usually called mentally retarded, requires specific learning approaches and methods adapted to the individual needs of students. Research conducted at SLB C Autism Negeri Kedungkandang provides an overview of the effectiveness of the learning methods applied in teaching the concept of multiplication. The research results showed that out of a total of 6 students, 4 were able to do multiplication independently, while 2 others still needed help. These results are the result of learning the multiplication arithmetic operation.

1. Number of Students Who Are Able to Master Multiplication Independently

From the research results, there were 4 students who were able to work on multiplication questions without help. This shows that the learning method used has been successful for some students. These students may have achieved a fairly good level of understanding of the concept of multiplication and are able to apply it independently.

2. Number of Students Who Need Help with Multiplication

A total of 2 students still need help in doing multiplication. This shows that although the learning methods used are effective for some students,

there are still a large number who need additional support. Factors such as cognitive level, limitations in understanding abstract concepts, and different learning styles can be the cause.

3. Success Percentage

If we look at the percentage, only around 66.6% (4 out of 6) students are able to do multiplication independently. This shows that current learning methods have not achieved optimal levels of success. A total of 33.3% of students (2 out of 6) required assistance, indicating the need for adaptation and development of more effective methods.

4. Need for Adjustment of Learning Methods

Children with intellectual disabilities or what are usually called mentally retarded have different characteristics and learning styles, so the learning methods applied must be adjusted to be effective. A personalized approach is essential to meet each student's individual needs. For example, the use of visual aids such as number cards and math manipulatives can help clarify abstract concepts such as multiplication. Interactive and digital learning media, such as applications on tablets, also provide an interesting and fun way to learn mathematics.

In addition, it is important to pay attention to the need for one-on-one or small group learning for students who require more intensive attention. This approach allows teachers to provide more specific and direct instruction according to each student's abilities and learning pace. Teachers must also be specially trained in effective teaching techniques for children with intellectual disabilities, including strategies for maintaining students' attention and motivation.

Regular evaluation of student progress is necessary to assess the effectiveness of the methods used and make necessary adjustments. By adjusting learning methods based on this evaluation, education can become more adaptive, ensuring that every student gets an equal opportunity to understand and master the material being taught.

5. The Role of Teachers and Training

Teachers play a key role in the successful learning of children with intellectual disabilities or mental retardation. They not only act as learning facilitators but also as key motivators and supporters for students. To be able to carry out this role effectively, teachers need to have an understanding of the characteristics of intellectual disabilities and appropriate teaching techniques. Specialized training is needed so that teachers can develop the skills needed to adapt learning methods according to individual students' needs.

Teacher training should include visual and interactive teaching strategies, the use of educational technology, and personalized pproaches to learning. In addition, teachers need to be trained to conduct regular evaluations of student progress and adjust teaching methods based on the results of these evaluations. With adequate training, teachers can create a learning and supportive environment, helping students with intellectual disabilities reach their maximum potential.

6. Technology and Assistive Tools

The use of technology and assistive devices in the education of children with intellectual disabilities or mental retardation can greatly increase the effectiveness of learning. Technology, such as interactive learning applications on tablets, offers an engaging and adaptive way to learn the mathematical concept of multiplication operations. These apps usually come with features that allow children to learn at their own pace and get immediate feedback, which is very helpful in the learning process.

In addition to digital technology, physical aids such as math manipulatives (e.g., number blocks or multiplication boards) also play an important role. This tool allows students to visualize and manipulate numbers, so that abstract concepts such as multiplication become more concrete and easier to understand. By combining digital technology and physical tools,

learning can become more dynamic and tailored to students' individual needs, giving them a better opportunity to understand and master the material being taught.

7. Holistic Approach

A holistic approach to the education of children with intellectual disabilities or intellectual disabilities involves attention to all aspects of a child's development, not just academic abilities. Family involvement is a key component in this approach. Involving parents and family members in the home learning process can provide consistent additional support and increase continuity of learning.

In addition, a multisensory approach that combines various learning methods involving the visual, auditory and kinesthetic senses can make learning more interesting and effective. This method helps children understand the material better through various delivery methods that suit their learning style.

A holistic approach also includes attention to the child's social and emotional development. Collaborative activities and group games, for example, teach not only academic skills but also social skills, helping children develop the ability to interact with peers. With this approach, education becomes more comprehensive, supporting the child's overall development.

8. Continuous Evaluation and Assessment

Continuous evaluation and assessment is very important in the education of children with intellectual disabilities to ensure the learning methods used are effective and appropriate to the individual needs of students. Regular evaluations help teachers to identify progress and difficulties faced by students, thereby enabling timely adjustments to learning strategies.

Qualitative assessments, such as direct observations and progress notes, provide insight into student understanding that may not be apparent through written tests alone. Meanwhile, quantitative assessments, such as tests and quizzes, help measure academic achievement objectively. Evaluation results are used to design more effective interventions, adjust teaching methods, and provide additional support for students who need it. This process ensures that every student gets an equal opportunity to succeed and develop according to his or her potential.

4. Conclusion

L earning mathematics is often a challenge for students, especially in understanding the concept of multiplication. Multiplication skills are important for advanced mathematics and everyday life. One way to overcome this difficulty is to use innovative learning media, such as multiplication boards. At SLB C Autism Negeri Kedungkandang there are several students in class 10 SMALB who have difficulty understanding multiplication calculation operations, therefore the researcher intends to examine the effectiveness of multiplication board media for mentally retarded students in class 10 SMALB. This study aims to evaluate the effectiveness of the multiplication board in improving the mathematics learning outcomes of grade 10 students with intellectual disabilities. The methods used include observation, intervention, pretest and posttest, as well as interviews with teachers and students. This research has revealed that the use of a multiplication board can improve the ability of multiplication calculation operations in mentally retarded students in class 10 SMALB at SLB C Autism Negeri Kedungkandang. From the results obtained, it can be seen that there is a significant increase in the final test score

compared to the initial test score. Before using the multiplication board, most students were in the "unable" and "underprivileged" categories. After intervention with the multiplication board, there was an increase to a higher category, indicating that this method was effective in helping students understand the concept of multiplication.

This increase shows the importance of visual aids and learning methods adapted to the individual needs of students with intellectual disabilities. Multiplication boards not only aid in understanding concepts, but also give students a concrete tool to visualize the multiplication process, which is often abstract and difficult to understand. However, this research also reveals that despite improvements, there are still students who need additional help. This emphasizes the importance of approach and personalization in the education of children with special needs. Teachers must be equipped with special training to be able to adapt teaching methods to suit the needs of each student. In addition, family involvement and the use of technology and other assistive tools can also play an important role in supporting learning.

Overall, this research confirms that an approach that is structured and tailored to individual student needs can provide better results in the education of children with intellectual disabilities. Continuous evaluation and assessment is necessary to ensure that the methods used remain effective and can be adjusted according to student development. In this way, it is hoped that mentally retarded students can achieve their maximum potential in the learning process. With these positive results, it is hoped that the Kedungkandang State Autism SLB C can continue to develop innovative and effective learning methods, as well as become an example for other educational institutions in efforts to improve the quality of education for children with special needs.

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