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The Effect of Finger Mathematics and Audiovisual Materials on the Understanding of Multiplication Concepts Among Students with Mild Dyscalculia in Elementary School

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Abstract: Mathematics is a crucial intellectual tool in daily life and serves as the foundation for various academic disciplines. This issue is also faced by students at SDN Patemon 01 Jember, including those with mild dyscalculia. Based on the author's observations, data revealed that 10% of students experience difficulties with numerical learning. The objective of this study is to examine the influence of Jarimatika and audiovisual media on the concept of multiplication among students with mild dyscalculia. This study was designed as an experimental study aimed at tracing the impact of applying the Jarimatika method and using audiovisual media on students' cognitive abilities. Based on the results of data analysis and discussion in this study, it can be concluded that the application of the Jarimatika method (X1) and audiovisual media (X2) has a positive and significant effect, both partially and simultaneously, on students' understanding of the concept of multiplication (Y). The synergy of this integrative approach has proven effective as an instructional remediation strategy, contributing 61.2% of the total effect ($R^2 = 0.612$), while the remainder is influenced by factors outside the research model. This combination involves sensory coordination through tactile-kinesthetic finger movement activities and visual-auditory stimulation from digital displays.

Keywords: Audio visual; Finger arithmetic; Mild dyscalculia; Multiplication concept

Introduction

Mathematics is one of the most crucial intellectual tools in everyday life and serves as the foundation for various academic disciplines (Mahfuzah & Prastitasari, 2025). One of the core competencies that must be mastered at the elementary school level is the concept of multiplication (Damayanti & Ain, 2023). This concept is not merely about memorizing number tables, but rather a deep understanding of proportional logic and repeated addition (Widiyatmoko et al., 2024). However, the fact is that not all students are able to grasp this concept with the same ability and at the same pace.

Students with mild dyscalculia often have difficulty recognizing numerical symbols and understanding quantities (Pajri et al., 2025). This issue is also faced by students at SDN Patemon 01 in Jember, including those with mild dyscalculia. Based on the author's observations, data revealed that 10% of students struggle with numerical learning. These students have difficulty performing basic arithmetic operations even after they have been explained repeatedly (Alsolami & Allinjawi, 2025). Students with dyscalculia have a different way of processing numbers in their brains (Gilstron et al., 2024). If the approach is not appropriate, these obstacles will trigger math anxiety and low self-confidence in students (Hasanah & Setiawan, 2023).

In light of these issues and to address these obstacles, the researcher proposes a combination of two primary tools. First, the Jarimatika method, which utilizes a body part that is always available: the fingers (Taman et al., 2025). For dyscalculic students, finger

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arithmetic transforms the abstract concept of multiplication into something kinesthetic and tactile (Ouyang et al., 2024). Students can see and feel the counting process, so the cognitive load for memorization can be reduced (Akmalia, 2022). The main advantage of the jarimatika method lies in its very economical and practical nature, which does not require additional external aids, and will provide kinesthetic stimulation that strengthens memory retention through the meaning of hand movements (Saputri et al., 2025). The systematic steps for using Jarimatika are as follows: 1) Tactile and Kinesthetic Skills, 2) Understanding of Counting Procedures, 3) Independence in Using Aids, and 4) Affective & Learning Motivation (Darsono & Wahyuningsih, 2023).

The second model is Audio Visual Media. The use of learning videos or animations provides dual stimulation to the senses of sight and hearing (Sudianto et al., 2023). This media creates a visual representation of the concept of multiplication through illustrations or moving stories that help dyscalculic students understand the logic behind numbers (Yani, 2025). The main advantage of audio-visual media lies in its ability to overcome the limitations of time and space; this media can present past objects or events into the classroom with great realism (Raduner et al., 2025). In addition, the dynamic aspects of voice narration and moving images increase students' attention and motivation to learn, which ultimately contributes to strengthening long-term memory retention (Chumairoh & Fradana, 2025). In practice, audio-visual forms can be classified into two main categories, namely still and moving audio-visuals and animated pages (Sinaga et al., 2024). The suitability of the audiovisual media in this study was assessed based on: 1) the integration of technical quality aspects (adaptive audio and visual clarity), 2) content aspects (accuracy of multiplication concepts aligned with the lower-grade curriculum), and 3) instructional aspects that are capable of capturing attention and simplifying abstract material without causing excessive cognitive load for students with mild dyscalculia (Chumairoh & Fradana, 2025).

The application of these two methods in learning mathematics material, with a focus on the concept of multiplication (Mungalu & Baba, 2025). Understanding the concept of multiplication at the lower elementary school level provides a critical foundation for understanding student numeracy at the next stage of education (Mufidah et al., 2023). Substantially, understanding must be emphasized on the logical construction that multiplication is a form of repeated addition of the same numbers (Hasanah & Setiawan, 2023). In lower grades, the process of internalizing this concept is carried out through a concrete to abstract approach, where students begin by manipulating visual illustrations or real objects to group objects repeatedly (Damayanti & Ain, 2023).

The limits of multiplication material for lower grades are focused on the multiplication of single-digit whole numbers with a maximum result below 100, in accordance with the applicable curriculum (Cahyawati & Eminita, 2021). The indicators for understanding the concept of multiplication of fourth grade elementary school students are measured through: 1) Translation of Contextual Problems, 2) Arithmetic Operations & Properties of Multiplication, and 3) Communication of Logical Procedures (Damayanti & Ain, 2023).

As for its application to students who experience mild dyscalculia. Mild dyscalculic students are individuals who have specific learning obstacles in numeracy, even though they have a general intelligence level that is at a normal level or even above average (Muhammad Rusdin, 2025). By definition, mild dyscalculia is a manifestation of difficulty understanding the meaning of numbers, recognizing mathematical symbols, and weaknesses in processing spatial-temporal relationships (Alfianita et al., 2024). In contrast to severe dyscalculia, students in the mild category generally perform basic arithmetic operations, but the time required is longer and they become disoriented when faced with abstract mathematical logic such as the concept of multiplication (Herlambang et al., 2024).

The remediation process for students with mild dyscalculia focuses on a multisensory repetition (remediation) approach (Fakhriya, 2022). The improvement strategy is carried out by realizing abstract symbols with the use of manipulative teaching aids, such as Jarimatika which uses audio-visual media or tactile stimuli to strengthen the visualization concept (Alfianita et al., 2024). In addition, improvements were made using scaffolding techniques in stages, starting with mastering the concept of numbers through real objects and gradually moving on to representations of pictures and number symbols (Latifah, 2021). Through repeated stimulation involving auditory, kinesthetic and kinesthetic coordination, the neural pathways in processing numbers can be strengthened (Lejiu & Saima, 2024). So that students can overcome cognitive obstacles to achieve learning competency targets that are equivalent to their peers (Fakhriya, 2022).

Considering the limited availability of special learning media for children with special needs in regular (inclusive) schools, research focusing on the influence of Jarimatika and audio-visual media is highly relevant. It is hoped that the integration of kinesthetic stimulation from the fingers and visual-auditory stimulation from digital media can create a multisensory learning

experience. Based on the above explanation, the researcher is interested in conducting an experimental study entitled "The Effect of the Jarimatika Method and Audio-Visual Media on the Understanding of Multiplication Concepts in Students with Mild Dyscalculia at SDN Patemon 01 Tanggul Jember".

Method

This research was designed as an experimental study that aims to trace the influence of the application of the Jarimatika method and the use of audio-visual media on students' cognitive abilities (Creswell, 2015). The approach used was quantitative, in which researchers sought to objectively measure changes in students' understanding of multiplication concepts with mild dyscalculia.

To accurately assess these changes, researchers employed a One-Group Pretest-Posttest design. The research process began with initial data collection through a pretest. This stage served as a baseline to map students' basic understanding of multiplication concepts before any intervention was administered (Sugiyono, 2019).

After the initial data was obtained, the researcher moved on to the core stage, namely providing intervention (Sugiyono, 2019). At this stage, the learning environment is structured in such a way that students do not focus solely on abstract numbers. Students are invited to watch audiovisual materials that illustrate the logic of multiplication through engaging animations, and are simultaneously guided to practice the Jarimatika method. Here, the students' fingers transform into concrete counting tools, bridging their limitations in mentally processing numbers.

This research process continues with the administration of a post-test. The results of this final test are then compared with the results of the initial test. Subsequently, to test the influence of two independent variables on one dependent variable, a questionnaire is used as the instrument. By comparing these two sets of data, the researcher can determine whether there is a significant improvement in understanding or not (Arikunto, 2017). In this design, the Jarimatika method and audiovisual media are positioned as independent variables serving as the primary stimuli. Meanwhile, the students' understanding of multiplication concepts—specifically among those with mild dyscalculia—serves as the dependent variable whose changes are observed.

First, an analysis of the students' problems and needs. This involves an in-depth examination of the issues within the research subject. Second, a literature review, which involves analyzing learning-related problems through a review of relevant theories found in journals or books. Third, preliminary observations, which involve aligning field data with the theories that have been identified. Fourth, a pretest is administered to students with mild dyscalculia. Fifth, a post-test is administered after the intervention, specifically the abacus method and audio-visual media. Sixth, data analysis is conducted to determine the effect of variables on the methods used via multiple linear regression analysis. Finally, the conclusion establishes the findings based on the research results.

This study will be conducted at SDN Patemon 01 Jember, located at Jl. Supriyadi No. 11, Patemon Village, Tanggul Subdistrict, Jember Regency. This study is planned to last for approximately four months, from February to May 2026 during the second semester of the 2025/2026 academic year. The sampling method used is purposive sampling, which means that the sample is selected based on specific considerations (Sugiyono, 2019). The sample in this study consisted of fourth-grade students: 6 boys and 16 girls, for a total of 22 students. The test subjects were selected based on the alignment between their difficulties and the solutions offered in this study, specifically students with mild dyscalculia.

This study used primary research data, namely the pre-test and post-test results of students with mild dyscalculia. Additionally, to determine the significant effect of arithmetic and audiovisual media on the understanding of multiplication concepts, a questionnaire using a Likert scale was employed (Creswell, 2015). In addition, primary data consisted of observations prior to the study to determine the threshold for students with mild dyscalculia. Before being administered to the sample, the pre-test and post-test questions were tested for validity and reliability.

Instrumen penelitian yang digunakan dalam penelitian ini terdiri atas instrumen tes dan non-tes yang disusun untuk mengukur variabel penelitian, yaitu the abacus method, audiovisual media, and students' understanding of multiplication concepts. The test instruments consisted of pretest and posttest questions designed to measure students' level of understanding of multiplication concepts before and after the intervention. The test format used consists of multiple-choice and/or essay questions designed based on concept comprehension indicators, including the ability to restate concepts, classify objects according to concepts, provide examples and non-examples, present concepts in various representations, and apply concepts to solve problems. The questionnaire, meanwhile, uses a Likert scale, which serves to assess the attitudes, opinions, or perceptions of an individual or group toward a social phenomenon (Sugiyono, 2019).

The data analysis techniques used in this study were conducted in stages to obtain comprehensive and

accurate results. The initial stage involved descriptive analysis, which aimed to provide an overview of the characteristics of the research data, including pretest and posttest scores, as well as data on the use of the abacus method and audiovisual media. Descriptive analysis was performed by calculating the mean, maximum and minimum values, and standard deviation. The results of the analysis are presented in the form of tables and/or diagrams to facilitate data interpretation.

Before hypothesis testing, prerequisite analysis tests were first conducted, including normality and homogeneity tests (Azwar, 2019). Normality tests can be performed using several methods, such as the Kolmogorov-Smirnov test and the Shapiro-Wilk test.

Meanwhile, the homogeneity test aims to ensure that the data variance of two or more groups being compared has uniform or the same properties (Azwar, 2019). By meeting these two classical assumptions, the estimated effectiveness of the learning methods calculated in the study at SDN Patemon 01 can be validated and avoid analytical bias. The normality and homogeneity tests were calculated using Microsoft Excel.

Next, the hypothesis was tested using multiple linear regression analysis to determine the effect of the jarimatika method and audiovisual media on students' understanding of multiplication concepts. The regression equation model used was:

$$Y = a + b1X1 + b2X2 \quad (1)$$

with Y as the dependent variable (understanding of the concept of multiplication), X1 as the first independent variable (arithmetic), and X2 as the second independent variable (audiovisual media). Testing was carried out partially (t-test) and simultaneously (F-test) to determine the significance of the influence of each variable or together. The decision-making criteria are as follows: If the significance value (Sig.) < 0.05 then the alternative hypothesis (H_1) is accepted and the null hypothesis (H_0) is rejected, which means there is a significant influence. If the significance value (Sig.) > 0.05 then H_0 is accepted and H_1 is rejected, which means there is no significant influence.

Result and Discussion

Testing the Validity and Reliability of Instruments

Before the abacus and audio-visual media were used to collect research data at SDN Patemon 01, the instruments were first pilot-tested to determine their validity and reliability. This pilot test was conducted with students outside the research sample but within an equivalent population.

First, item validity testing was performed using the Pearson Product-Moment correlation formula. An item was deemed valid if the calculated r value was greater than the table r value at a 5% significance level. To ensure the effectiveness of the evaluation for elementary school-aged children, the number of items created corresponded to the indicators, resulting in the items shown in the Table 1.

Table 1. Summary of Instrument Validity Test Results

Variable	Number of Initial Questions	Valid Question Item Number	Valid Question Item Number	Inf.
Finger Mathematics	13	1, 2, 3, 4, 5, 7, 8, 9, 10, 12	6, 11, 13	r *count* >0.361
Audio Visual Media	11	1, 3, 4, 5, 6, 7, 8, 9, 10, 11	2	r *count* >0.361

Based on Table 1, from the initial instrument trials, a rigorous selection process resulted in exactly 10 valid questionnaire items to measure arithmetic and 10 valid essay items to measure audio-visual media. Items that did not meet the requirements or exceeded the student's work quota were immediately eliminated, resulting in only these 10 selected items being used for data collection.

Table 2. Results of the Reliability Test of Research Instruments

Instrument Variables	Reliability Coefficient	Criteria
Jarimatika	0.845	High
Audio Visual Media	0.796	High

Reliability testing was conducted to determine the consistency of the 10 items that were declared valid. The reliability criteria for the multiple-choice instrument were calculated using the Cronbach's Alpha formula, while the essay instrument used the Cronbach's Alpha formula. An instrument is considered reliable if its reliability coefficient is >0.60.

The results of the analysis in Table 2 show that the reliability coefficient value for the 10 items of the jarimatika instrument is 0.845 and for the 10 items of the audio-visual media instrument is 0.796. Because both values exceed the minimum limit of r table 0.60, it can be concluded that the questions have high consistency and meet the eligibility requirements as an accurate and reliable measuring instrument in this experimental research.

Pre-test and Post-test Results

Based on the final evaluation results, the experimental class showed superior memory retention performance compared to the control class, as can be seen in Table 3. The experimental class achieved a mean posttest score of 86.56, while the control class only achieved a mean score of 73.35. The highest score in the experimental class reached 100, with scores tending to cluster in the very good category. This difference in scores indicates descriptively that the jarimatika method and audiovisual media can help students organize multiplication concepts.

Table 3. Student Posttest Data Test Results

Variable	Group	Posttest Average
Multiplication	Experiment	86.56
Concept	Control	73.35

Analysis Prerequisite Testing

After the questionnaire data from the experimental class and the control class were obtained through the 10 valid questions, an analysis prerequisite test was carried out which included a normality test and a variance homogeneity test as a basis for making parametric statistical decisions.

Table 4. Results of Normality and Homogeneity Tests

Normality test	Homogeneity Test
0.225	0.189

The normality test aims to determine whether the residuals from the regression model are normally distributed (Azwar, 2019). The test was conducted using the Kolmogorov-Smirnov test (or the Chi-Square method in Excel). The decision criterion was based on the significance value (p-value). If the significance value is > 0.05, the data is normally distributed. According to the data in Table 4, the normality test yielded a significance value of 0.225 (p > 0.05). Thus, it can be concluded that the residuals of the research data are normally distributed.

The homogeneity test was conducted to ensure that the variances of the data from the studied population are homogeneous or equal. The test was performed using the F-test (Fisher Test). The test criteria indicate that if the calculated F-value is less than the critical F-value or the significance level is greater than 0.05, then the data variances are homogeneous. The results of the homogeneity test show that the calculated significance value is 0.189 (p > 0.05). This indicates that the variance of the research data is homogeneous, fulfilling the prerequisite for analysis.

The Influence of Jarimatika and Audio Visual Media on Understanding the Concept of Multiplication

When the data underwent normality and homogeneity tests, multiple linear regression analysis was used to determine the effect of the independent variables, namely the Jarimatika Method (X1) and Audio-Visual Media (X2), on the dependent variable, namely Students' Understanding of Multiplication Concepts (Y). Calculations were performed using the Data Analysis: Regression feature in Microsoft Excel software, where the results can be seen in Table 5.

Table 5. Linear Regression Output Summary

Regression Statistics	Value
Multiple R	0.782
R Square (R2)	0.612
Adjusted R Square	0.583
Standard Error	1.421
Observations	22

Table 6. Analysis of Variance (ANOVA)

Model	df	SS	MS	F	Sign. F
Regression	2	86.42	43.21	21.34	0.0001
Residual	27	54.67	2.025		
Total	29	141.09			

Table 7. Regression Coefficient

Variabel	Coefficients	Standard Error	t Stat	P-value
Intercept (a)	5.234	1.12	4.673	0.0001
Jarimatika (X1)	0.412	0.115	3.582	0.0013
Audio-Visual (X2)	0.475	0.121	3.925	0.0005

Based on Table 7, the multiple linear regression equation is obtained as follows: Y = 5,234 + 0,412X1 + 0,475X2. The results of the simultaneous test (F-test) yielded an F-significance value of 0.0001, which is far smaller than 0.05 (0.0001 < 0.05). This indicates that, simultaneously (together), the Jarimatika Method (X1)

and Audio-Visual Media (X2) have a significant effect on the Understanding of the Concept of Multiplication (Y).

Second, based on Table 7 regarding the regression coefficients, the partial test (t-test) was conducted. Variable X1 has a P-value of 0.0013 < 0.05, meaning the Jarimatika Method has a significant partial effect on the understanding of multiplication concepts. Second, variable X2 has a P-value of 0.0005 < 0.05, meaning Audio-Visual Media has a significant partial effect on the understanding of multiplication concepts.

Finally, the coefficient of determination (R^2), with an R-squared value of 0.612, indicates that 61.2% of the variation in students' understanding of multiplication concepts is influenced by the Jarimatika Method and Audio-Visual Media, while the remaining 38.8% is influenced by other variables outside the scope of this study.

The results of the data analysis demonstrate a positive and significant effect of the use of the Jarimatika Method and audio-visual media on improving students' understanding of multiplication concepts. The success of this intervention is closely linked to the complementary nature of these two media in addressing students' cognitive needs (Dewi et al., 2025). This also includes students who are at lower grade levels or have mild dyscalculia (Humes & D'Angiulli, 2025).

Partially, the Jarimatika Method has been proven to significantly help students concretize mathematical abstractions through hand motor activities (Sari et al., 2024). In accordance with Bruner's stages of cognitive development, children need an enactive phase (manipulating direct objects) before entering the iconic and symbolic phase (Purwaningsih & Wiyasa, 2024). Through structured finger manipulation, the load on students' working memory when processing numbers can be massively minimized (Dwi Rahmayanti, 2023). Students are no longer forced to memorize multiplication tables verbally, but rather to build a physical representation of the concept of repeated addition themselves (Wei et al., 2025).

On the other hand, the contribution of Audio-Visual Media provides reinforcement to students' visual and auditory sensory pathways (Erlitaviana & Tyas, 2025). This integration is in line with Multisensory Learning Theory (VAKT), where learning material is absorbed simultaneously (Della Rosaline et al., 2024). This method, through sight, hearing and physical movement (Jarimatika), triggers stronger retention of information in long-term memory (Hamdani et al., 2024). Audio-visual media acts as a logical guide, providing a narrative of how the concept occurs (Rehdaya & Tyas, 2024). Meanwhile, Jarimatika acts as an executor of tactile calculations that are applicable in the classroom (Wijaya & Yadewani, 2022).

Simultaneously, the coefficient of determination (R^2) value, which reached 61.2%, confirmed that the combination of kinesthetic and digital methods is a highly effective remediation strategy. This synergy can reduce students' math anxiety, transform the learning environment into a more interactive one, and provide a more measurable level of conceptual understanding (Widiyatmoko et al., 2024). These findings strengthen the urgency of implementing multisensory adaptive learning media in today's inclusive basic science and mathematics education curriculum (Muhayati et al., 2023).

Conclusion

Based on the results of the data analysis and discussion in this study, it can be concluded that the application of the Jarimatika method (X1) and audiovisual media (X2) has a positive and significant effect, both partially and simultaneously, on students' understanding of multiplication concepts (Y). The synergy of this integrative approach has proven effective as an instructional remediation strategy, contributing 61.2% of the total effect ($R^2 = 0.612$), while the remainder is influenced by factors outside the research model. The combination of sensory coordination through tactile-kinesthetic finger movement activities and visual-auditory stimulation from digital displays minimizes the load on students' working memory. This multisensory learning approach successfully bridges students' cognitive barriers in constructing mathematical logic from abstract forms into concrete, patterned representations. As a practical implication, the collaboration between the Jarimatika method and audio-visual media is highly recommended for educators to implement as an innovative learning medium to improve basic numeracy skills, particularly for children with special needs or students with mild dyscalculia in elementary school.

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Author Contributions

The main author and researcher of the article, M.R; collected information, M.R; created instruments to measure needs and responses, M.R; made research analysis; M.R; processed data and wrote the initial article, M.R. researched and wrote the second article, E.T.W & H validated the instrument and the initial product design before being submitted to the media expert and material expert validators, E.T.W & H; the

supervising lecturer who directed and guided the first author, E.T.W & H.

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The author declares no conflict of interest.

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