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The Creativity of Mentally Retarded Students in Solving Plane Problems with Image Media

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Abstract

Mental retardation is a condition of someone who has intellectual skills below average. In this context, the learning process for mentally disabled students requires a different strategy when compared to learning for regular students. Mathematics has the characteristics of an abstract concept. Learning requires media so that the message conveyed by the teacher to students can be adequately achieved. For this reason, learning mathematics requires media such as pictures. In this regard, this study aimed to determine the increase in the creativity of mentally disabled students in solving mathematical problems using media images. The indicators of invention used in this study are fluency, flexibility, and originality in thinking. This study used one subject with mental retardation characteristics selected by purposive sampling. This single-subject research uses an ABA design. The instrument used in this study was a mathematical creativity test given to subjects in each session. Data analysis techniques use visual techniques, including analysis within and between conditions. The results showed that the subjects were stable at the first baseline, averaging 66.63. The issues were stable at the intervention, with an average of 79.18. in the retrieval or the second baseline phase, the subjects were in an unstable situation with an average of 62.72. Apart from that, in between conditions, it was found that between the first conditions had increased. Between the second condition, it decreased because media images were not used in learning mathematics. These results indicate that using media images can improve the creative mathematical abilities of mentally disabled students.

Keywords: Creativity of Mathematical, Image Media, Plane Problem, Retarded Student

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INTRODUCTION

Creativity is a cognitive activity that generates new perspectives on a problem and is not limited to pragmatic results (Baas et al., 2013; Jauk et al., 2014; Solso et al., 2005). Creativity is reflected in fluency, flexibility, and originality in thinking (Chen et al., 2015; Ersoy, 2014; Leikin, 2013; Siswono, 2005, 2010, 2016). Creativity is the ability to imagine, interpret and express ideas and use creativity to find new combinations of pre-existing elements to improve the quality of student self-development (Ehrenstorfer et al., 2013; Joynes et al., 2019; Putri, 2013). Creativity is the ability to create something new, either a new thing or idea, by connecting several existing items and making something new (Guilford, 2017; Manzini, 2014). Creativity will produce various innovations and recent developments in the surrounding environment (Oksanen & Ståhle, 2013; Somech & Drach-

Zahavy, 2013) so that one's creativity will always be needed in their environment. For that, creativity must be built early to improve the quality of life.

During the Covid-19 pandemic, students became less enthusiastic about learning, so the level of student creativity also decreased (Irfan et al., 2020; Kanca et al., 2020; Saleh et al., 2021; Saputra et al., 2021). This is in line with the results of previous research conducted by Maharani et al. (2020), which stated that junior high school students with different academic abilities show that academic ability tends to be directly proportional to the ability to think creatively. The average element of creative thinking in students with high theoretical knowledge shows a percentage of 33% in all four aspects, and in students with low academic ability shows a ratio of 26% (Maharani et al., 2020). Even though the skill to think creatively is a combination of logical and divergent thinking skills that can produce many ideas and their use in solving a problem (Kurniawan et al., 2018; Siswono, 2011; Webb et al., 2017). Creative thinking is one of the skills needed in the 21st century, so it dramatically impacts the quality of human resources (Siswono, 2010, 2011). In addition, if you apply to the current curriculum, this ability is one of the elements of the Pancasila student profile, which is the focus of character in the curriculum of Merdeka (Wijayanti et al., 2022).

Indonesian children's creativity level is among the lowest compared to other countries. The 2015 Global Creativity Index (GCI) places Indonesia at 115th out of 139 countries (Muthmainah, 2022; Perizade, 2020; Rustiadi & Arina, 2019). However, all students should develop their creativity in solving problems. In fact, student's creativity is very low. Creative potential is significant for children because students' creativity are curious and encouraged in complex tasks, dare to take risks, and not easily discouraged (Putri, 2013). The stages of the creative thinking process can be seen in synthesizing, building, planning, and implementing ideas (Ferdiani & Khabibah, 2022; Hidajat, 2021; Husna & Kurniasih, 2019; Ibrahim & Widodo, 2020). In each stage, the ability to think creatively refers to the indicators of the ability to think creatively, namely fluency, flexibility, and novelty (Handayani et al., 2020; Siswono, 2010, 2011).

Different students' creative abilities and additional limitations are tricky for teachers to balance learning with other students (Ellerton, 2013; Ferri et al., 2020). Students' creative abilities vary, especially students with certain restrictions, one of which is a student with mental retardation. Students with mental retardation have different characteristics. The characteristics of mentally retardation students are abstract knowledge, forgetting quickly, physical disabilities, and lack of movement development (Widodo, Prihatiningsih, et al., 2021). Mentally retardation students tend to be quiet and calm with themselves (Kutsyuruba et al., 2015). In essence, mentally retardation students need special education services and special attention (Spiel et al., 2014). Services can be in the form of students' physical, social, and psychological development. Based on the IQ level of mentally retarded children can be classified into 4, namely mild mental retardation (IQ: 51-70), moderate mental retardation (IQ: 36-51), severe mental retardation (IQ: 20-35), very severe mental retardation (IQ < 20) (Istiqomah et al., 2022). Different abilities and material achievements will emerge in student creativity in solving problems given the limitations of mentally retardation students, namely low intellectual power and easy boredom, so that learning media, such as images on flat shape material Different material abilities and achievements will appear in students' creativity in solving problems given the limitations of mentally retarded students, namely low intellectual power and getting bored quickly, so that learning media (Istiqomah et al., 2022; Puspitaloka et al., 2022; Widodo, Prihatiningsih, et al., 2021), such as images on flat shape material can be used as an alternative for trite learning of students with these characteristics (Istiqomah et al., 2022; Puspitaloka et al., 2022; Widodo, Prihatiningsih, et al., 2021).

The habit of mentally retardation students who tend to be alone and quiet results in low ability of mathematical creativity of mentally retardation students (Rimm et al., 2018). Students with mental retardation significantly have intelligence below the average normal child in general, and the development of children's intelligence is below the actual age growth (Apriyanto, 2012). Mentally retardation children have characteristics including difficulties in learning new things, forgetting quickly, physical disabilities, and lack of movement development (Nasyiithoh, 2019).

In this regard, this research aims to increase the creativity of mentally retardation students in solving mathematical problems using image media. Theoretically, using image media can spur mentally retardation students to be more enthusiastic and active in participating in learning mathematics (Goos et al., 2020; Herdiyanto et al., 2020; Sirait & Boediono, 2021). This media serves to convey messages from visual communication symbols. The aim is to attract attention, clarify the material, and illustrate facts and information (Kustandi & Sutjipto, 2011). Image media is the most straightforward media, it simply uses paper, scissors, a pencil, and a ruler (Amir, 2016; Robinson & Rae, 2014). However, media images are more interesting if the pictures are colorful. The use of media images intends to increase student creativity. Flat shape material is one of the subjects to determine the ability of mathematical creativity, especially in plane material. A plane is a shape with two dimensions, length and width, but not height and thickness (Liu et al., 2014; Zhuang et al., 2015). One of the learning media in flat wake material is image media. So, learning media assisted by image media can be used as alternative learning for mentally retardation students to increase their level of creativity.

METHODS

This type of research is experimental with a single-subject or Single Subject Research (SSR). Single-subject research has the characteristics of the sample size used in the study, namely, only one subject or one group of not more than five people (Widodo, Kustantini, et al., 2021). Experimental research was carried out on a single subject to know the magnitude of the effect of the treatment given repeatedly on the behavior you want to change at a particular time (Datiilo et al., 2000; Kazdin, 2021; Smith, 2012; Sunanto et al., 2005). The treatment in this study was using media images, while the behavior observed in this study was creativity as measured using three indicators: namely fluency, flexibility, and originality in thinking (Ferdiani & Khabibah, 2022; Handayani et al., 2020; Hidajat, 2021; Husna & Kurniasih, 2019; Ibrahim & Widodo, 2020; Siswono, 2010, 2011).

The research design used is ABA. This design develops the basic A-B design by repeating the baseline phase after the intervention phase (Prahmana, 2021). The first baseline phase (A) measures students' abilities before being given treatment. In this phase, a minimum of 3 sessions are carried out until the data is stable, with a duration of 60 minutes per session and per day. In this phase, mentally retardation students are given a mathematical creativity test on flat shape material. Data from the results of this test are used as initial data before being given treatment or treatment.

Furthermore, the intervention phase (B) was carried out for at least three sessions until the data stabilized with 60 minutes per session and day. In this phase, mentally retardation students are given treatment in the form of learning activities assisted by media images which are continued by providing tests of students' mathematical creativity abilities after being given treatment. The research design can be seen in Figure 1 (Prahmana, 2021; Sunanto et al., 2005).

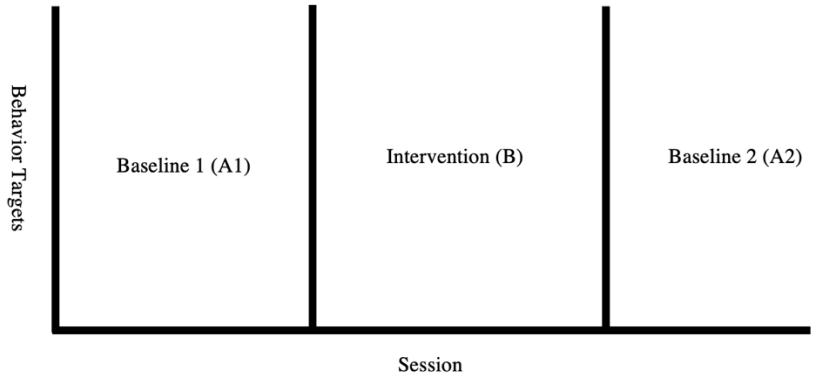


Figure 1. Research Design ABA

In taking the sample, the researcher used a purposive sampling method, namely, a selection considering specific characteristics or characteristics. The use of purposive sampling in this study was due to the difficulty of finding students with the features desired by the researchers, namely students with mental retardation characteristics. For research ethics, mentally retardation students who are used as different research subjects are referred to as "X". This subject is a class VII student at State SLB in Yogyakarta. Subject "X" is female, aged 13 years, domiciled in Tamanan, Banguntapan, Bantul, Yogyakarta, with everyday language using Javanese and Indonesian.

Data collection techniques through mathematical creativity tests. The independent variable in this study is the use of media images, while the dependent variable is the mathematical creativity abilities of students with mental retardation in flat shape material. The instrument for testing the ability of mathematical creativity is validated by three experts who are competent in their fields. This validity sheet refers to a quantitative scale, namely, 4 with an excellent category, 3 with a good category, 2 with a very less category, and 1 with a very good category (Mardapi, 2017). A summary of the validation results of the three aspects can be seen in Table 1.

Table 1. Criteria and Aspect Limit Value

Aspects assessed by the validator	Total score for the expert	Criteria
Material aspects	11	Good
Construction aspect	12	Good
Language aspect	12	Good

Based on Table 1, it can be seen that the average score was obtained from several aspects. With these results, it can be concluded that the research instrument can be declared valid with a good category.

After the data was collected, to find out that the intervention, in this case, media images given to mental retardation students, had a positive effect on creativity, a visual analysis was carried out (Prahmana, 2021; Widodo, Kustantini, et al., 2021; Widodo, Prihatiningsih, et al., 2021). Visual analysis was performed by providing graphs to interpret the effect of the intervention (Brossart et al., 2014; Kipfmiller et al., 2019; Widodo et al., 2020). In addition, visual analysis can be carried out by comparing data points or data points on graphs that show baseline conditions with data points that show intervention conditions or reach data points that show behavior during an intervention (Kazdin, 2021; Lane & Gast, 2014). Visual analysis in this study was carried out by analysis under and between conditions (Gast & Ledford, 2014; Lane & Gast, 2014; Prahmana, 2021; Sunanto

et al., 2005). The components of the analysis under conditions include (1) length of condition; (2) directional inclination; (3) level of stability determined by calculating data in the range of 50% above and below the mean; (4) rate of change calculated by finding the difference between the first and the last data; (5) data trail, and (6) range, which is the distance between the first data and the last data and calculated based on the values derived by multiplying the values of the highest score on the condition with the stability criterion (0.15). The components of the analysis between conditions include changes in (1) variables; (2) trend direction and their effects, (3) stability criterion and its effects, and (4) data levels (changes in data determined by finding the difference between the last data in the baseline condition and the first data in the intervention condition), and changes due to (5) overlapping data (overlap), determined by the formula (same data in both conditions/data in baseline condition) × 100.

RESULTS & DISCUSSION

Results

Based on the results of the mathematical creativity ability test that was carried out for ten days, the results obtained in the first baseline phase (A), the intervention phase (B), and the second baseline phase (A) are shown in Table 2.

Table 2. Subject X creativity test scores in Baseline 1, Intervention, and Baseline 2 Phases

Phase	Session	Score
A	1	62.50
	2	66.60
	3	70.80
B	4	75.00
	5	79.20
	6	79.20
	7	83.30
A	8	62.50
	9	70.80
	10	70.80

As shown in Table 2, the data obtained can also be expressed in diagrammatic form shown in Figure 2. Furthermore, the data is analyzed visually by analyzing conditions and between conditions. Conditions analysis includes condition length, data trend, stability trend, data trace trend, stability level, data range, and level change (Prahmana, 2021; Widodo, Kustantini, et al., 2021). Analysis inter-conditions consist of the number of observed variables, the trend of data, changes in the trend of stability, changes in levels, and percentage of overlap (Prahmana, 2021; Sunanto et al., 2005; Widodo, Kustantini, et al., 2021).

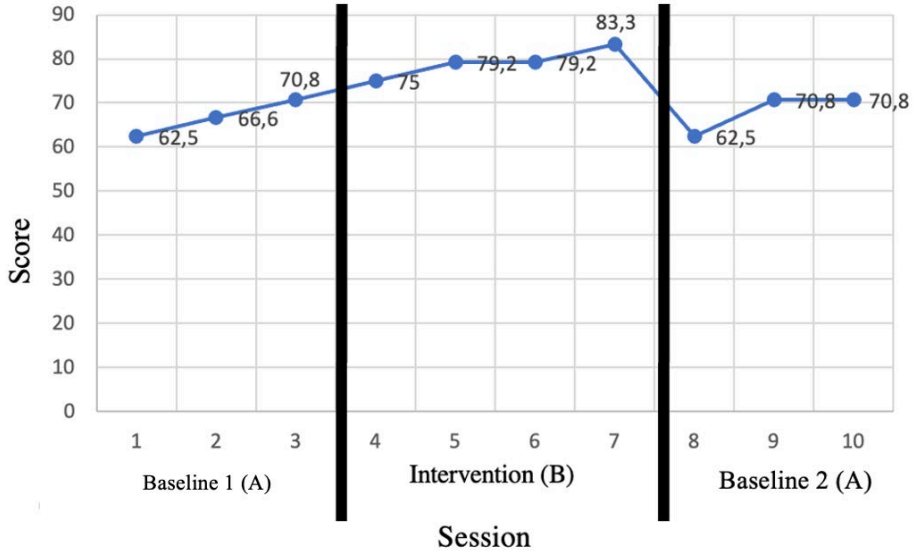


Figure 2. Graph of Baseline 1, Intervention, and Baseline 2.

Under Conditions Analysis

Under condition analysis is an analysis of data changes under one condition. This study involved three phases, namely the first baseline phase, intervention, and retrieval phase or second baseline phase, so the analysis of the conditions included all three steps. The summary of the results of the analysis in its essentials is presented in Table 3.

Table 3. Summary of Analysis Results in Conditions

Component	Condition		
	Baseline 1	Intervention	Baseline 2
Length of Condition	3	4	3
Estimation of Directional Trends	/	/	/
Trend of Stability	Stable (100%)	Stable (100%)	Variable (66.67%)
The trend of Data Footprint	/	/	/
Level of Stability and Range	Stable 62.5 – 70.8	Stable 75.0 – 83.3	Variable 62.5 – 70.8
Level of Change	70.8 – 62.5 = (+8.3)	83.3 –75.0 = (+8.3)	70-8 – 62.5 = (+8.3)

Based on Table 3, it was found that the length of the first baseline, intervention, and second baseline phases were 3, 4, and 3. The length of this condition indicated the number of sessions or meetings used to collect data from research subjects. Concerning the estimation of the trend direction and trend of the data trail, both at the first baseline, the intervention, and the second baseline, tend to increase (/). This shows that subject X tends to increase the ability of mathematical creativity for each session in the phase.

In the first baseline phase A, to determine the stability trend with the 15% criterion, the calculation is

Stability range = Highest score × Stability criteria = 70.8 × 0.15 = 10.62.

Mean Level $= \frac{(62.50+66.60+70.80)}{3} = \frac{199.9}{3} = 66.63.$

Determine the Upper Limit = Mean level + Half of the stability range

$= 66.63 + 5.31 = 71.94.$

Determine the Lower Limit = Mean level – Half of the stability range

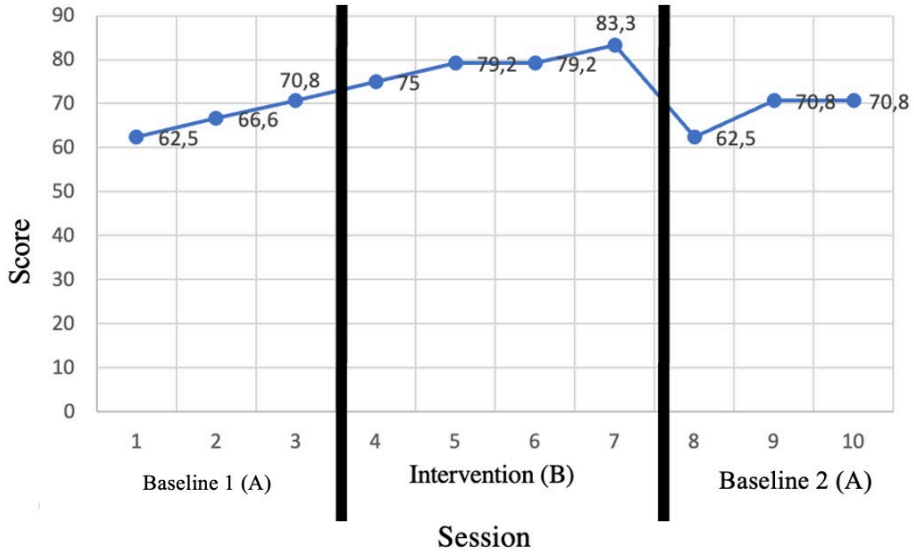
$= 66.63 - 5.31 = 61.32.$

So the stability range is 61.32 to 71.94.

Determine the percentage in the stability range $= \frac{\text{Many data points exist in a range}}{\text{The number of data points}} \times 100\%$

$= \frac{3}{3} \times 100\% = 100\%.$

The percentage of stability of 85% - 90% is stable when it is below; it is said to be unstable (variable) (Sunanto et al., 2005) because the calculation result for the first baseline phase is 100%, a stable result is obtained for the stability trend and level of stability. The same calculation found that the percentage in the stability range of 100% was obtained in the intervention phase so that stable results were obtained for the trend of stability and the level of stability. Different from the second baseline phase, it was found that the percentage in the stability range was 66.67%, so the result of unstable (variable) was obtained for the trend of stability and the level of stability. The data for each step showed that the level change was +8.3 for each phase, and the second baseline was unstable. This instability is because only two of the three data range from 62.72 to 73.34.



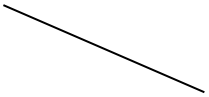
Inter-Condition Analysis

Analysis between conditions is a change in data between a situation, for example, the baseline condition (A) to the intervention condition (B). In this study, there were two analyses between conditions: baseline to intervention and between conditions from intervention to baseline 2. The summary of the analysis results in the conditions is presented in Table 4.

Based on Table 4 data, it was found that the number of variables changed was one, namely the baseline condition (A) to intervention (B). Level changes are calculated by calculating the difference between the highest data from the previous phase and the lowest data from the next phase. The sign (+) indicates an improvement, the signal (-) indicates a worsening change, and (=) indicates no change. The subject's mathematical creativity ability in the baseline phase 1 (A) to the intervention phase (B) increased by +8.3 (see Table 3), while in the intervention phase (B) to the baseline 2 phase (A), it decreased by 20.8 or (-20.8), this shows that there was an increase in conditions after being given treatment and

a decrease when not being given treatment. In addition, it is also supported by the presence of a low percentage of overlap.

Table 4. Summary of Analysis Results of Inter-Condition

Component	Comparison between conditions	
	Baseline 1 to Intervention (A/B)	Intervention to Baseline 2 (B/A)
Number of Changed Variables	1	1
Changes in Direction Trends and Their Effects		
Changes in Stability Trends	Stabil to Stabil	Stabil to variable
Level of change	(70.80 – 75.00) (+4.2)	(83.3 – 62.5) (–20.8)
Overlapping changes	0%	0%

Overlapping data is the occurrence of the same data in the baseline conditions with the intervention. The overlapping data shows no change in the two conditions. The more overlapping data, the more it confirms that the intervention in the study cannot be carried out anymore because it does not affect any changes. There are three ways to determine data that overlap in comparing the baseline and intervention phases. *First*, look again at the upper and lower limits of the first baseline, intervention, and second baseline phases. *Second*, it counts the number of data points in the intervention phase (B) within the first baseline phase (A) range, which is 0. Likewise, in the second baseline phase (A), within the intervention phase (B) range, namely 0. *Third*, the overlap percentage is 0%; the smaller the percentage of overlap means, the better the effect of the intervention on the target behavior. From this explanation, the degree of overlap between the first baseline phase (A) that are within the range of the intervention phase (B) is 0%, and the overlap between intervention phase (B) that are within the range of the second baseline phase (A) is 0%.

Discussion

Learning media can be used as a tool to increase motivation and even student learning abilities if the learning media can be a tool for conveying good learning messages to students (Ashari et al., 2020; Hakim et al., 2019; Utami et al., 2022; Verawati et al., 2022). This is in line with the function of learning media, which is to transmit information (learning messages) between the source (teacher) and the recipient of the message (students) (Widodo, 2018; Widodo, Irfan, et al., 2019). Learning media is a learning aid, namely, anything that can be used to stimulate the thoughts, feelings, attention, and abilities or skills of students so that they can encourage the learning process (Widodo, 2018; Widodo, Dahlan, et al., 2019).

For cognitivism, learning media are usually understood as objects brought into the classroom to help the learning process more effectively (Kozma, 1994; Naidu, 2006). Although for constructivism, learning media is not limited to what the teacher uses in the classroom, but in principle, includes everything that exists in the environment of students where they interact and help the teaching and learning process (Chotimah et al., 2018; Greenhow & Lewin, 2016). For this reason, for mentally disabled students, the media is used as a means for students to understand what is explained, including mentally disabled children who have problems with concentration and memory (Astuti & Sari, 2020; Eisvandi

et al., 2015; Pradipta & Dewantoro, 2019; Singh & Agarwal, 2013). For this reason, in this study, learning media is the focus of treatment or intervention given to mentally disabled students.

This research was conducted in three phases: the baseline phase, the intervention phase, and the baseline return as a retrieval phase. The activities carried out in the baseline phase aim to obtain initial data about the creative thinking abilities of mentally retarded students. The results obtained in the baseline phase for three sessions showed that the subject's knowledge increased based on graphs and calculations under conditions. In addition, it was demonstrated by the average student's mathematical creative thinking ability of 66.63, with a subject stability level of 100%. Under these conditions, intervention is needed by providing learning media in the form of images to mentally retarded students so that their critical mathematical thinking skills increase.

The intervention phase was carried out for four sessions. This phase is the experimental phase of giving treatment using media images in learning mathematics. Media images are expected to improve students' mathematical creative abilities in dealing with mathematical problems. The research results show that the subject's ability tends to increase based on graphs and calculations under conditions. In addition, it was demonstrated by the average student's mathematical creative thinking ability of 79.18, with the subject's stability level of 100%. In the retrieval phase, or the second baseline phase, the average student's mathematical creative thinking ability was 68.03, with subject stability of 66.67% in the reasonably unstable (variable) category.

In addition, the results of subject X's work in the first baseline phase showed that the subject needed to develop optimal mathematical creativity abilities. This was because the issue only wrote directly. For example, in Figure 3, in the first question, the subject only wrote, “punya 4 sisi, punya sumbu simetri lipat, punya 2 diagonal berpotongan” (in English: has 4 sides, has a folding axis of symmetry, has 2 intersecting diagonals). Then in question 2, subject X writes correctly. Subject X did not use a ruler when drawing a square, even though a ruler was provided to solve the second problem. So that the subject shows flexibility in solving problems, in this regard, it can be concluded that in the first baseline phase, subject X needs to improve their creative abilities in dealing with mathematical problems.

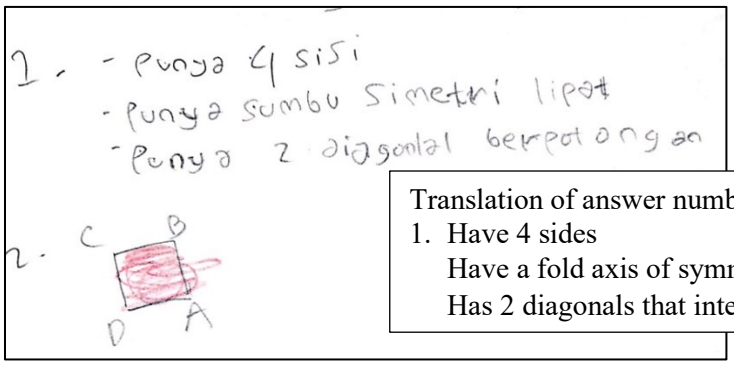
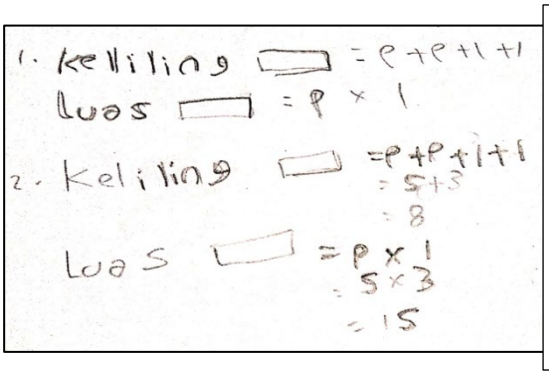


Figure 3. The answer to subject X Mathematical Creativity Ability Test on the first Baseline

In the intervention phase, learning uses image media. Subject X began to look enthusiastic and happy while participating in learning. After that, it comes to the point, namely providing flat-shape learning to students with mental retardation with the help of

media images. Based on the problems studied, the subject prefers learning using media. One of the results of Subject X's work in the intervention phase can be seen in Figure 4.



Translation of answer Number 1 and 2

1. Circumference of rectangle = $p + p + l + l$
   Area of rectangular = $p \times l$
2. Circumference of rectangle = $p + p + l + l$
   $= 5 + 3$
   $= 8$
   Area of rectangular = $p \times l$
   $= 5 \times 3$
   $= 15$

Figure 4. The answer to subject X Mathematical Creativity Ability Test on the Intervention Phase

Based on Figure 4, the subject can show several characteristics of creativity, such as fluency, flexibility, and novelty (Ferdiani & Khabibah, 2022; Handayani et al., 2020; Hidajat, 2021; Husna & Kurniasih, 2019; Ibrahim & Widodo, 2020; Siswono, 2010, 2011). This can be shown in question number one "*keliling persegipanjang adalah* $p + p + l + l$*, luas persegipanjang adalah* $p \times l$" (in English: the around of rectangle is $p + p + l + l$, the wide of the rectangle is $p \times l$). The subject showed fluency in solving this problem. During the intervention phase, the subject looked enthusiastic about participating in learning. The subject always asks things that are not understood. According to Subject X, learning media using pictures is fun and exciting and makes it easier to understand the material. In the intervention phase, the subject looks enthusiastic about participating in learning. The subject always asks things that are not understood. He says teaching media using pictures is fun and exciting and makes it easier to understand the material.

These results indicate that using instructional media has a positive effect on the creative mathematical abilities of mentally retarded students. Even though the average mathematical creativity ability has decreased in the second baseline or the retrieval phase, the condition is unstable. The decrease in the average mathematical creativity in the second baseline phase and the instability in the ability of mentally retarded students is because, in this phase, learning mathematics does not use media images. Therefore, using media images in learning mathematics causes the creative mathematical abilities of mentally retarded students to increase. In addition, this result is supported by the analysis of the first inter-conditions, namely from A1 to B, which experienced an increase, and decrease in conditions B to A2.

This study's results align with previous research, which found that learning media in the form of images implemented in the Treffinger learning model influenced the creative abilities of class VII students of SMP Negeri Palangkaraya (Malini et al., 2022). The research results are in line with the literature study conducted by Puspitaloka et al. (2022), which states that the learning media used in learning for mentally disabled students so far is in the form of visual media and has an impact on increasing interest and enthusiasm for learning mild mentally disabled children. In addition, previous research also found that using media images can improve the understanding of the circle concept in class VIII students of Junior High School number 1 in Batang Onang (Amir, 2016; Hasibuan, 2013).

Although the studies from Amir (2016) and Hasibuan (2013) were conducted on students who were not mentally retarded, the characteristics of mentally retarded students who tended to have learning disabilities required learning to use media so that the messages

given by the teacher to students could be adequately conveyed. Like previous studies that used visual media to introduce numbers and counting to mental retardation students (Maroofi et al., 2018; Pradani et al., 2015; Yunisa & Fatmawati, 2018). Therefore, using media images in learning mathematics is a part of the teaching method, which attempts to enable a learning process that combines facts and ideas to explain material in mathematics. In mathematics, media images facilitate the learning process based on the belief that the learning process, with the help of media images, can improve student learning outcomes to achieve the goals of learning mathematics (Marti et al., 2014; Puspitaloka et al., 2022; Widodo et al., 2018). With media images, it is hoped that students' knowledge and understanding of mathematical concepts will be better and can foster interest and motivation for them to learn mathematics.

CONCLUSION

Based on the results of this study, it can be concluded that using media images can improve the creative mathematical abilities of mentally retarded students. This can be seen from subject X's average mathematical creativity ability during the baseline, intervention, and retrieval or second baseline phases. In connection with these results, it is hoped that in mathematics learning, mentally retarded students can use media images so that mentally retarded students' mathematical creative abilities can increase. Although it does not rule out the possibility that further researchers can conduct further research such as factors that can improve students' mathematical creative skills.

CONFLICT OF INTEREST

There is no conflict of interest in this research

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