RESEARCH ARTICLE

Physical activity based on manipulative exercise: how it affects the gross motor of children with autism for 12 years old?

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Abstract
This study aims to determine the effect of manipulative exercise on gross motor ability in students with grade V autism at SDLB who are 12 years old. The method and design used in this study is single-subject research using an Applied Behavior Analysis (ABA) design. Researchers use test techniques in the form of instruments that use an event score recording system by providing checks/notes on paper that have been provided for each event or behavior that occurs up to a predetermined period. Data collection is carried out by observation and documentation techniques which are then analyzed using visual analysis under conditions. The results of this study provide a conclusion that manipulative exercises have an influence on the gross motor ability of students with autism, so manipulative exercises can be used as an alternative to improving gross motor ability. This success may be influenced by several other factors that limit this study such as social, cultural, linguistic, and possibly even genetic characteristics that can be used for further study. The recommendation for further research is to conduct further research by paying attention to the limitations of this research.

Keywords
Physical Activity, Manipulative Exercise, Gross Motor, Children, Autism

INTRODUCTION

Motor development includes fine motor and gross motor. Gross motor development is important because it affects other developmentsto optimize motor skills, practice is required (Burns et al., 2017a). Motor skills will not develop in the absence of the maturity of motor control, motor control will not be optimal without body fitness, and body fitness will not be achieved without physical exercise. Motor skills, especially gross motor skills, are very important to be mastered by children because with gross skills children will be able to carry out their daily activities and be useful for their growth and development in the future (Azizah et al., 2022; Gil Madrona et al., 2014). Without good movements, children will lag behind others, including autism.

In an autistic child, if he is given good motor exercises, then his motor development will be good anyway. Training motor skills in autistic children aims to make their motor nerves develop optimally (Phytanza, Burhaein, et al., 2021; Phytanza, Purwanta, Hermanto, Burhaein, et al.,

2021). Motor nerves can be trained and developed through regular ongoing activities and stimuli. Motor skills in a child must be trained and developed early. Motor exercises can be done with initial basic motion exercises, namely locomotor motion, nonlocomotor motion and manipulative motion (Healy et al., 2018).

Motor skills can develop in line with the maturity of the brain and nerves. Therefore, every movement that a child makes, even though it is simple, is actually a result of the interaction patterns of various complex system parts in the body that are controlled by the brain (Phytanza, Purwanta, Hermanto, &Burhaein, 2021; Phytanza& Burhaein, 2019). The brain serves to control and regulate all the physical and mental activities of a person. Gross motor movements are in the form of body movements related to large muscles such as running, kicking, tiptoeing, jumping, catching, throwing, and maintaining balance. Such activities are necessary to improve the coordination skills of gross motor movements.

The development of gross motor movements is closely related to physical or physical activity that uses large muscles (Burhaein et al., 2021; Burns et al., 2017b). These large muscles such as shoulder muscles, arm muscles, leg muscles, abdominal muscles, and back muscles are affected by physical maturity and these movements can usually be done by children (Burhaein et al., 2020; Mokhamad Parmadi Agus Setia Budi Wisnu Murtiansyah Ari Susanto, 2022). In everyday life, gross motor movements can be seen or encountered when seeing a child is playing. Examples of gross motor movement skills performed by children at the time of such as children playing chasing by running, jumping, jumping, or playing ball by kicking, throwing, and bouncing it. The movement is strongly influenced by the physical and psychic development of children with autism.

Gerak motorik kasar biasanya memerlukan lot of power, as it is done by large muscles. Gross motor movements involve the activity of the muscles of the legs, muscles of the hands, and the whole body of the child. Gross motor movements are influenced by maturity in coordination. Various kinds of gross motor movements that can be achieved by children will be very useful for their future lives. For example, children are accustomed to kicking balls and running, if they grow up, they will enjoy exercising. If he likes to exercise, his muscles will be stronger and his immune system

will increase and will avoid various diseases. On the contrary, if motor skills are not developed then the problem will increase and expand as the child ages. For example, if the initial basic movements such as locomotor motion, non-locomotor motion and manipulative motion are not trained, it can result in the child showing awkward and rigid movements due to lack of coordination or frequent falls while walking.

In Yogyakarta, Indonesia there is a special school to deal with children with autism, the name of the school is the extraordinary school (SLB) "X". Within the school there are several classes, ranging from early intervention classes consisting of behavioral therapy classes, occupational therapy classes, and speech therapy classes. Other classes found in SLB "X are kindergarten classes (TKLB), transitional classes and classes for the elementary school level (SDLB). Transition classes are preparatory classes to prepare students with special needs (autism) to be able to participate in learning activities together with students in general. Autistic students attend special schools using the Indonesian independent curriculum which has been modified according to their abilities and needs.

One of the autistic children who attended SLB "X" is a "BS" student, he is in class V of SDLB and is 12 years old. According to the results of observations that have been made by researchers at SLB "X" shows that the gross motor ability "BS" still needs to be optimized. It can be seen when throwing and catching the ball. He seemed to hesitate when he was about to catch the ball. The ability to throw the ball is also not good, he has not been able to make the movement of throwing the ball correctly, because he seems to throw the ball down instead of doing the movement throwing the ball correctly, namely throwing forward or upwards. "BS" also hasn't been able to jump, bend over and tiptoe using both legs. The sports activities participated by "BS" at SLB "X" include gymnastics which is carried out every day before eating at school, throwing catch the ball, dexterity training, and ball kicking exercises. The way teachers teach ball catch throwing is to do the practice of throwing catch the ball directly in a standing position. At first, the teacher instructs "BS" to stand up and place the "BS" into the throwing area to catch the ball, then the teacher gives the instruction "BS, catch the ball!" and then BS

catches the ball. And at the time of throwing the ball, Master gives the instruction "throw the ball!" then BS throws the ball held by him. If at the time of throwing catch the ball BS encountered obstacles, then the teacher providedassistance.

Based on this description, there is a focus on the effect of manipulative exercise on gross motor ability, which is formulated in the research question, namely, how does manipulative exercise affect the gross motor ability of students with autism class V SLB "X"? So the purpose of this study was to analyze the effect of manipulative exercise on the gross motor ability of students with autism class V SLB "X".

MATERIALS AND METHODS

Research Method

In the research conducted, researchers use quantitative methods with a type of single-subject research (SSR) namely experimental research using single-subject research to find out how much influence a treatment is given to subjects. Single Subject Research is a study that focuses on behavioral changes in the cognitive, psychomotor, and affective realms caused by behavior/action/intervention in one subject being studied (Gast, 2009; Horner et al., 2005; Peng, 2020). The data in this study were obtained through experimental techniques, namely, the research was carried out using two variables, namely free variables and bound variables which then tested the influence of independent variables on dependent variables. In this study, the single subject of the field of behavior modification into bound variables is the target behavior that wants to be changed by providing certain actions or interventions.

In Single Subject Research, there are three kinds of research designs, namely: 1) A-B design, 2) A-B-A design, and 3) A-B-A-B design. The A-B-A design is one of the developments of the basic A-B design. This A-B-A design shows a stronger causal relationship between free variables than the A-B design. The design used in this study was the A-B-A design. Measurements in the A-B-A design are carried out by comparing the first baseline condition (A1) with a certain period of time and then measurement at the intervention condition (B) at a certain period, followed by re-measuring in the second baseline condition (A2) at a certain period as a change to know or convince the existence of a strong functional relationship between the free

variable and the stronger bound variable, So that a conclusion can be formulated from the results of these measurements.

Participants

This study was conducted on one autistic child of grade V SDLB, aged 12 years who attended SLB "X" with the initials BS. The initial ability that the child has is quite good, namely compliance behavior has been formed. His gross motor skills are still lacking, it can be seen when researchers make observations at SLB "X". It can be seen when throwing and catching the ball. He seemed to hesitate when he was about to catch the ball. The ability to throw the ball is also not good, he has can't make the movement of throwing the ball correctly, because he seems to throw the ball down, not doing the movement of throwing the ball correctly. BS also hasn't been able to jump, bend down, and tiptoe using both legs. From the results of this study, the intervention of subjects with autism is expected to be able to improve gross motor abilities through manipulative exercises so that later their motor nerves can develop optimally.

Instruments

As previously stated, this research is a quantitative study with the type of Single Subject Research which was carried out to improve gross motor ability in grade V students with autism using manipulative exercises at SLB "X". Researchers use a test technique in the form of an instrument that uses an event score recording system by providing a check/noteon the paper that has been provided for every event or behavior that occurs up to a predetermined period. To get the desired data, then pay attention to the following:

1. Definition of Conceptual

Gross motor ability is the ability of students to perform gross motor movements that require coordination of most parts of the body and are more demanding on physical strength and balance in the form of movements involving large muscles.

2. Definition of Operational

Gross motor ability is a score obtained by students after a test. This score describes the learner's ability to perform movements involving large muscles, including (1) rolling the ball using two hands, (2) passing the ball using two hands and (3) catching the ball using two hands.

3. *Lattice - Instrument Grille*

The stages of compiling student instruments are to compile a grid in the form of a specification table based on variables.

Table 1. Gross motor capability instrument grilles in class V learners with autism in SLB "X"

Variable	Aspects	Indicators	Item Number	Sum
Ability Gross motor	Strength big muscles	1. Learners are able to roll the ball using two hands well	1	1
		2. Learners are able to pass the ball using two hands appropriately	2	1
		3. Learners are able to catch the ball using two hands well	3	1
		Total	**3**	**3**

Grade Criteria

1. If the subject is able to perform movements independently is given a score of 3;
2. If the subject is able to perform movements with little help is given a score of 2;
3. If the subject is able to perform movements with the help of all of them is given a score of 1.

Data Collection Technique

The data collection technique carried out in this study is a test. Researchers used the deed test on subjects starting from the first baseline (A1), intervention (B), and second baseline (A2). The first baseline (A1) aims to determine the outcome of the subject's ability before obtaining an intervention. The second baseline test (A2) is useful for obtaining the results of the subject's abilities after obtaining the intervention.

1. *First Baseline Phase (A1)*

This phase is the initial condition of the gross ability of motor in the subject before receiving treatment. From here the researchers looked at the ability of the gross motor to roll, pass the ball and catch the ball to the learners without being given any treatment and recorded what the learners did. This first baseline phase is carried out repeatedly until the learner's state stabilizes, to find out the initial abilities that the subject has before being given treatment using manipulative exercises. More details can be seen in Figure 1.

2. *Intervention Phase (B)*

It is an intervention condition of the gross motor ability of the subject during the treatment process. The intervention is carried out using manipulative exercises aimed at helping to improve gross motor abilities. This stage of intervention is carried out repeatedly until the subject can perform this stage to the maximum

until it stabilizes. To measure the gross motorability of subjects are taughtmanipulative exercises. Manipulative exercises consist of 4 stages, namely, the first stage (basic) of rolling the ball, the second stage of bouncing the ball, the third stage of passing the ball, and the fourth stage of catching the ball which is carried out in a standing position. More details can be seen in Figure 1.

3. *Phase A2 (Second baseline)*

This stage is the stage of adding conditions for drawing conclusions. In this stage, students perform movements to roll the ball, throw the ball and catch the ball after manipulative exercises are carried out in the previous stage, namely the intervention phase (B). More details can be seen in Figure 1.

Information

A. A1 is the symbol of the flat line (first baseline). The first baseline is a natural initial condition of the subject without intervention.

B. B (intervention) is an intervention in which the subject is given repeated treatment.

C. A2 (baseline kedua) merupakan pengulangan kondisi A1 yang dilakukan sebagai evaluasi bagaimana intervensi berpengaruh terhadap subyek.

Data Analysis

In Single Subject Research, data analysis uses simple descriptive statistics and focuses on individual data influenced by the design used. This study used an A-B-A design with data processing techniques using percentages. A percentage is a unit of measure that is often used by researchers and teachers to measure behavior in academic and social fields. Percentage (%) is calculated by calculating the maximum score multiplied by 100%.
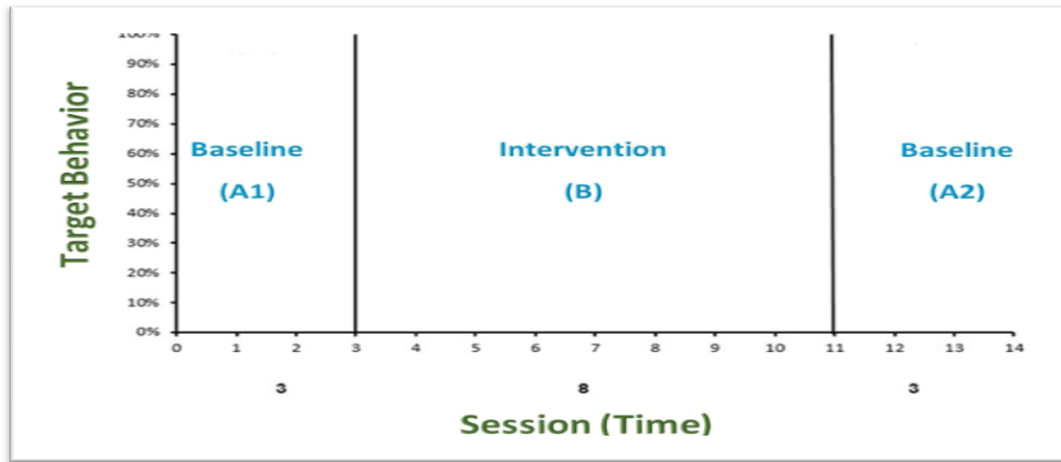
Figure 1. Data collection technique flow

Percentages $= \dfrac{\Sigma \text{ Acquired ability score}}{\Sigma \text{ maximum score}}$ x 100%

The analysis in this study uses visual analysis in conditions. Visual analysis in conditions is an analysis carried out by making direct observations of the data that has been displayed in the graph. The analysis components under conditions include six components, namely 1) Length of condition, 2) Estimated directional tendency, 3) Stability tendency, 4) Data footprint, 5) Level of stability and 6) Range / level of change. The steps for determining the six components of visual analysis under conditions based on this study are as follows:

1. Step 1: Specify a condition length that indicates the session in each condition or stage. In this study using disai A-B-A with the length of the condition at the first baseline (A1) was 3 sessions, the intervention (B) was 8 sessions and the second baseline (A2) was 3 sessions.
2. Step 2: Estimate the trend of the direction using the split middle method on the graph, and then determine the trend lin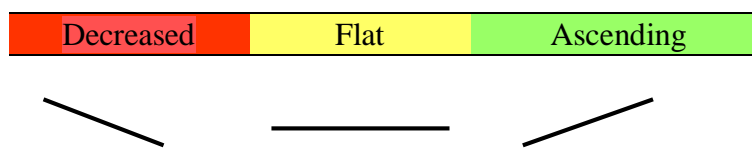e in the table that describes the downward, horizontal or ascending direction of the behavior being intervened in each session that needs to be measured. More details can be seen in Figure 2.
3. Step 3: Determine the stability tendency at stages A1, B, and A2 towards the measured behavioral targets. The percentage of stability is said to be stable if it is 85%-90%, while below that the variable is unstable. The percentage of stability at each stage is known by first determining the tendency to stability using the 15% stability criterion through calculations for each stage below:
   a. Stability range = highest data x 15%
   b. Mean level = total number of data: the amount of data.
   c. Mean level = total number of data: the amount of data.
   d. Lower limit = mean – half the stability range.
   e. Stability percentage = many data in the range: many data
4. Step 4: Determine the trend of traces at stages A1, B, and A2 towards each of the measured behaviors. It is the same as determining the directional trend.

Figure 2. Trend of the chart direction

5. Step 5: Determine the level of stability and range by writing down stable or variable data results and the range of data from the smallest data to the largest data at each stage.

Step 6: Determine the level of change by marking the first data and the last data at each stage. Then determine whether thedirection is increasing or decreasing by putting a sign (+) if it improves, (-) if it worsens, and (=) if there is no change. After knowing the calculation results of the six components analyzed, foBSat can be made or a summary table of the analysis results under conditions that can be used to describe the results of the study.

RESULTS

Baseline Stage Data Description (A1)

Before the researcher gave the treatment (intervention), the researcher made observations (data collection) about the gross motor ability of learners with class V autism in SLB "X". The purpose of observation is to measure and collect data on the gross motor ability of the subjects before the treatment (intervention). Observation is carried out by observing and recording the gross motor ability of the subject during sports activities.

At the baseline stage (A1), researchers measured and collected data on the subjects' initial motor gross ability without being given intervention. Measurement and data collection of target behavior 46 was carried out in three sessions, namely Monday, Wednesday, and Friday in the second week of August 2022 with a duration of 45 minutes in each session starting at 09.15 to 10.00 WIB. The score gain at this stage can be seen in the following table.

Table 2. Baseline condition stage score acquisition (A1)

Gross Motor Capability	Session			Average
	1	2	3	
1. Able to roll the ball using two hands well.	1	1	1	**1**
2. Able to roll the ball using two hands well.	1	1	1	**1**
3. Able to catch the ball using two hands well.	1	1	1	**1**

The data in the baseline condition stage score acquisition table (A1) showed that in sessionsone to session three, the average score obtained by the subjects at the baseline stage (A1) was 1 for each ability, namely rolling the ball, passing the ball, and catching the ball. In accordance with the description of the score obtained that has been described in the previous chapter, a score of 1 indicates that the subjects were fully assisted by the researcher in performing gross motor movements.

Based on the results of measurement and collection of target behavior data in the baseline condition stage score (A1) acquisition table conducted for 3 sessions, these results showed that students with grade V SDLB autism hade low gross motor ability. The results also show that the data has reached a stable level. Thus, the study can be continued to the next stage, namely the intervention condition (B).

Description of Intervention Stage Data (B)

The intervention stage (B) is a condition of gross motor ability intervention, that is, in the form of treatment given to subjects through manipulative exercises. The manipulative exercise begins with rolling the ball on the floor using two hands, then bouncing the ball to the floor using two hands, followed by passing and catching the ball using two hands which are done in a standing position. Intervention through manipulative exercises is carried out to determine changes in the gross motor ability of the subjects.

Intervention condition (B) was given to subjects in as many as eight sessions. The number of sessions conducted each week is 3 meetings on Monday, Wednesday, and Friday. Intervention conditions (B) were implemented in total at 8 meetings. The duration for each meeting is 45 minutes, starting at 09.00 WIB until 09.45 WIB. The score acquisition at this stage can be seen in the following Table 3.

Table 3. Acquisition of intervention condition stage score (B)

Gross Motor Capability	Session								Average
	1	2	3	4	5	6	7	8	
1. Able to roll the ball using two hands well.	2	2	2	2	2	3	2	2	**2,12**
2. Able to pass the ball using two hands appropriately.	2	2	2	2	2	2	2	2	**2**
3. Able to pass the ball using two hands appropriately.	2	2	2	2	3	2	2	2	**2,12**

The data in the table of obtaining the score of the intervention condition stage (B) shows that gross motorability in students with grade V SDLB autism has increased. The increase in gross motorability occurs in the ability to roll the ball, pass the ball and catch the ball. The average score obtained is 2.12 for the ability to roll the ball and catch the ball, while for the ability to pass the ball the average score obtained is 2. Based on these results, the provision of intervention in this intervention condition (B) can be stopped in the eighth session because the data on the intervention condition (B) is stable and can be continued to the second baseline stage (A2).

Baseline Stage Data Description (A2)

After treatment at the intervention condition (B), the next stage is the baseline stage (A2). The baseline stage (A2) is the repetition phase of baseline condition A1. The purpose of continuing

to the baseline stage (A2) is to find out or convince that there is a strong relationship between the free variable (manipulative exercise) and the bound variable (gross motor ability), namely by repeating in measuring and collecting data on the gross motor ability of the subject without intervention. Research at the baseline condition stage (A2) was carried out by observing and recording the gross motor ability when the subjects performed gross motor movements, namely rolling the ball on the floor using two hands, passing the ball using two hands, and catching the ball using two hands. At this stage, measurement and data collection are carried out in as many as three sessions, namely on Monday, Wednesday, and Friday. Phase A2 was carried out in total in 3 meetings with a duration of 45 minutes. The A2 condition stage starts at 09.00 to 09.45 WIB. The score at this stage can be seen in the following Table 4.

Table 4. Baseline condition stage score acquisition (A2)

Gross Motor Capability	Session			Average
	1	**2**	**3**	
1. Able to roll the ball using two hands well	3	3	3	**3**
2. Able to pass the ball using two hands appropriately.	2	2	2	**2**
3. Able to catch the ball using two hands well.	3	3	3	**3**

The data in the baseline condition stage score (A2) table shows that the gross motor ability of learners with grade V SDLB autism has changed (increased) from the intervention condition stage (B). This can be seen from the average score obtained by the subjects is 3 on the ability to roll the ball and the ability to catch the ball. In accordance with the description described in the previous chapter, a score of 3 indicates that the subject is able to roll the ball and catch the ball independently. As for the ability to pass the ball precisely, the results of measurements and data collection show that the ability to pass the ball has not changed (stable) from the stage of intervention condition (B). The average score obtained is 2 which means the subject is able to pass the ball precisely with little help.

Based on the score acquisition data at the baseline condition stage (A1), the interventioncondition stage (B) and the second baseline condition stage (A2) researchers can draw the conclusion that manipulative exercise has an influence on the gross motorability of learners with grade V SDLB autism.

From this analysis, the researcher can decide to stop the study until the second baseline condition (A2) stage because the data obtained is stable and the target has been achieved even though there is one gross motor movementthat still needs a little help, namely passing the ball correctly. From the data obtained from recording gross motor ability scores on the first baseline (A1), Intervention (B), and second baseline (A2), researchers compared these data and saw changes in gross motor abilityafter intervention using manipulative exercises. This can be seen in the following Table5.

DISCUSSION

Based on the results of the study, manipulative exercise has an influence on gross motor ability in grade V SDLB students with autism. This can be seen from the change in score acquisition which shows that the score gain at the intervention stage (B) has increased when compared to the measurement results and score acquisition at the first baseline stage (A1).

Table 5. Score acquisition of baseline condition stage (A1), intervention condition stage (B), and second baseline condition stage (A2)

Condition Stage	Session	Motor Gross Capability Score		
		Able to roll a ball well	Able to pass the ball appropriately	Able to catch the ball well
A1	1	1	1	1
	2	1	1	1
	3	1	1	1
B	1	2	2	2
	2	2	2	2
	3	2	2	2
	4	2	2	2
	5	2	2	2
	6	2	2	3
	7	2	3	2
	8	2	2	2
A2	1	2	3	3
	2	3	2	3
	3	3	3	2

Likewise, the score acquisition at the second condition stage (A2) has increased when compared to the score acquisition at the intervention condition stage (B).

The results of providing intervention conditions (B) through manipulative exercises showed that the acquisition of gross motor (gross motor) ability scores at the intervention stage (B) changed (increased) when compared to the score acquisition at the first baseline condition stage (A1).

The increase in gross motor ability occurs in the ability to roll the ball, pass the ball and catch the ball. In the second baseline condition stage (A2) it was seen that the acquisition of the ball rolling ability score and the ability to catch the ball increased when compared to the score gain in the intervention condition (B). However, for the ability to pass the ball, the results of measurement and data collection showed that the score gain at the second baseline condition stage (A2) did not developmental outcomes.Research Ketcheson et al. (2017) concluded that their findings highlight the importance of including motor programming as part of the early intervention services provided to young children with an autism spectrum disorder.

The novelty of this study compared to several previous studies is that the subject is at the grade V level of an elementary school in Indonesia. Based on the analysis data, it was concluded that the effect of this study showed that manipulative exercise has an influence on the gross

change (stable) when compared to the score gain at the intervention condition stage (B).This research is supported by several previous studies that can be used as a comparison, including Monteiro et al. (2022), Mohd Nordin et al. (2021), and Ketcheson et al. (2017).

Research Monteiro et al. (2022) gives the conclusion that considering the importance of physical activity clinically for children with ASD, a systematic review with this meta-analysis showed that physical activity did not have a statistically significant effect on coordination in individuals with ASD. Research Mohd Nordin et al. (2021) concluded that it is important to assess motor development in ASD children because there are significant motor delays in these children compared to developing children, and the delays become more pronounced with age. Early detection of motor delays can enable the provision of early intervention services to optimize

motor ability of students with autism, so manipulative exercise can be used as an alternative in increasing gross motor ability. This success may be influenced by several other factors suchas social, cultural, linguistic, and possibly even genetic characteristics that can be used for further study.

Conclusion

The results showed that manipulative exercises have an influence on the gross motor ability of students with autism, so manipulative

exercises can be used as an alternative in increasing gross motor ability. This success may be influenced by several other factorsthat limit thisstudy suchas social, cultural, linguistic, and possibly even genetic characteristics that can be used for further study. The recommendation for further research is to conduct further research by paying attention to the limitations of this research.

Conflict of Interest

We declare that this article we wrote has no involvement in any particular conflict of interest.

Ethics Statement

Penulisan Artikel Ini Telah Melalui Segala Prosedur raletika yang berkaitan dengan ranahakademis.

Authors Contribution

First author: problem formulation, methodology, data collection, data analysis, discussion, and article writing. **Second author**: methodology, data collection, data analysis, discussion, and article writing.**Third author**-methodology, data analysis, and discussion. **Fourth author**-methodology, data analysis, and discussion.

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