



Single Subject Research: Learning Algebra Operations in Introverted Students

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Abstract

This study aims to analyze the learning process of introverted students on algebraic operating materials and determine the results of treatment with Problem Based Learning on students' mathematical reasoning abilities. This type of research is an experiment with a single subject or Single Subject Research. The design used is A-B. Data collection techniques through observation, tests, interviews, and documentation. Data analysis uses analysis in conditions and analysis between conditions. Based on the results of the study, the introverted student learning process on algebraic operating material is the subject preparing needs, making designs, identifying, finding and delivering solutions, and conducting evaluations. While the treatment results in the form of Problem Based Learning showed a significant increase, the mean level of test results increased from 48.75 to 92.75 and the percentage of overlap was 0. It was concluded that the use of PBL models had a positive influence on the mathematical reasoning ability of introverted students. It is hoped that the Problem Based Learning model can be used as an alternative learning model to improve the mathematical reasoning ability of introverted students and learning when at school.

Keywords: Algebra Operations, Mathematical Skills, Introvert, Problem Based Learning

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INTRODUCTION

Algebra is one branch of mathematics that is important to study (Ikram et al., 2018; Nopriana, 2015). Algebra is used in everyday life to turn a problem into a mathematical sentence (Maskar, 2018; Visitasari et al., 2013). In solving mathematical problems there needs to be a cognitive attitude that plays a role in efforts to develop students' thinking processes, awareness of its benefits, fostering an objective attitude, self-confidence, and being open to facing the ever-changing future (Ansori & Herdiman, 2019; Fajriah et al., 2019; Masfingatin, 2013; Safrida et al., 2015; Widodo & Turmudi, 2017; Widyastuti, 2015). One cognitive attitude that includes this is the ability to reason (Mikrayanti, 2016; Rosnawati, 2013; Saputri et al., 2017; Sumartini, 2015). The reasoning is an important thing in human life, one important aspect of life is mathematics because it contains active, dynamic, and generative processes that are carried out by actors and the use of mathematics. The reasoning is a process of thinking to draw conclusions and make new statements based on previous statements whose truth has been proven (Sumartini, 2015).

In addition to mathematical reasoning abilities, different student behaviors make it difficult for teachers to deal with students and make teachers balance the ways of teaching

between students with one another. Differences in behavior among individuals occur due to the influence of different student personalities (Widodo, 2012). Human personality is divided into two types of personality based on the attitude of human souls, those are extroverted and introverted. (Keirse, 1998; Keirse & Bates, 1984). Extroverts and introverts are initially a person's reaction to something, but if the reaction is continuously carried out it will turn into a habit (Qomariyah, 2016). Students with introverted personalities tend to feel shy, low self-esteem, and have feelings of fear when dealing with new things (Sunarsih, 2012). A student with an introvert personality in determining his thoughts, feelings, and actions through subjective factors that cause unfavorable adjustments to the outside world (Hasanah & dan Sutrima, 2013). Some research that has been done before each type of student personality has a different way of solving each problem given (Widodo, 2013; Widodo & Turmudi, 2017; Yuwono, 2010). This is in line with the results of previous research which states that in solving mathematical problems, each student with a different personality is seen to have a different thought process (Sunarto, 2009).

The application of ordinary learning models by some mathematics teachers results in students' mathematical reasoning abilities classified as low qualifications (Mulyana & Sumarmo, 2015; Permana & Sumarmo, 2007). In contrast to problem-based learning, the results obtained indicate that students' mathematical reasoning abilities can increase and student personality can develop for the better (Bungel, 2014; Eismawati et al., 2019; Irfan & Nurul, 2017). So that problem-based learning can be used as alternative learning to improve the mathematical reasoning ability of introverted students. During this time, several studies have focused on using one class or two research sample samples with various types of student personalities in them (Eismawati et al., 2019; Puspitawedana & Jailani, 2016), but the research is only focused on one student (individual) who has an introverted personality to see students' mathematical abilities more deeply. This is done so that researchers can explore the problems or obstacles faced by introverted students and provide solutions related to these problems. Based on these objectives the purpose of this study is to analyze the introverted student learning process on algebraic operating material and the results of treatment with problem-based learning.

METHODS

This type of research is an experiment with a single subject or single subject research. The method of experimentation with a single subject or Single Subject Research is a research method that aims to obtain the necessary data by looking at whether there is an influence of treatment or treatment given to subjects by comparing the two conditions, namely with treatment and without treatment (Creswell, 2009, 2012). The design used is the baseline condition (A) and the intervention condition (B) or A - B (Sunanto et al., 2005). The main procedure adopted in the A - B design involves measuring the target behavior in the baseline phase which will be carried out for four sessions with a duration of 60 minutes per session per day. In this phase, an introverted student is given a test of mathematical reasoning ability on algebraic operating material. Data from the results of this test are used as preliminary data before treatment is given.

Furthermore, the intervention phase will be conducted for four sessions with a duration of 90 minutes per session per day. In this phase, an introverted student will be given treatment in the form of teaching and learning activities using a problem-based learning model, which will be followed by tests of students' mathematical reasoning abilities after being given treatment. During the intervention phase measurements are carried out on the target behavior continuously until it reaches stable data (Lovaas, 2003),

if there is a change in target behavior in the intervention phase after compared with the baseline, it is assumed that the change is due to the influence of the independent variable or intervention (Hartiningsih, 2013; Iswinarti & Cahyasari, 2017; Lovaas, 2003; Rusilowati, Anisa Sholihah, 2017; Sunanto et al., 2005). In general, the design of the study is depicted as shown in Figure 1.

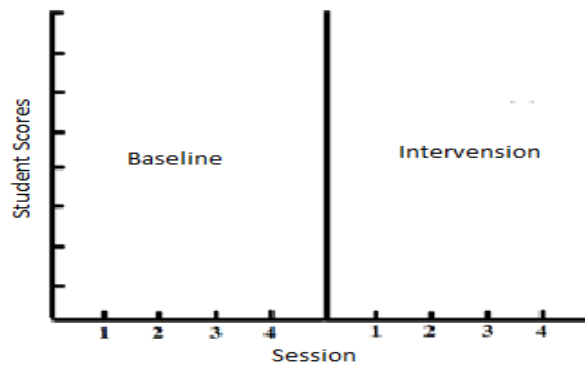


Figure 1. Research Design (Lovaas, 2003; Sunanto et al., 2005)

The subject used in this study was a grade 7 junior high school student with the introvert category. One student was taken because this study was single subject research so that only one subject was used in this study. The selection of these subjects was carried out by purposive sampling. Students of 7th at SMP Muhammadiyah 4 Yogyakarta are given a Keirsey Temperament Sorter test which aims to see the temperament of students. Of the students who have filled the Keirsey Temperament Sorter test, one student is selected with the introvert category according to the purpose of this study.

The independent variable in this study is the application of the problem-based learning model. While the dependent variable is the mathematical reasoning ability of introverted students in algebraic operating material. Data collection techniques used were observation (carried out before and during the study), test methods (there are two methods, namely personality tests using the Keirsey Temperament Sorter which were conducted before the study and tests of mathematical reasoning abilities conducted during the baseline and intervention phases), interview methods (done before research), and documentation (done during research). Mathematical reasoning ability tests are prepared by consulting mathematicians and mathematics teachers in advance. It is intended that this test is following the indicators of algebraic operations and the objectives of this study.

After the data is collected, the data will be analyzed using analysis in conditions and between conditions. Components of analysis in conditions include (1) length of conditions; (2) direction trends; (3) the level of stability can be determined by calculating the amount of data in the range of 50% above and below the mean; (4) the rate of change, can be calculated by finding the difference between the first data and the last data; (5) data-trace, and (6) range, which is the distance between the first data and the last date, can be calculated by finding the product of the highest score in the condition with the stability criteria (0.15). Meanwhile, the component analysis between conditions includes (1) the variable that was changed; (2) changes in trends in direction and effects, (3) changes in stability and effects, (4) changes in data levels, can be determined by finding the difference between the last data at baseline conditions and the first data at intervention conditions, and (5) overlapping data (overlap), can be determined by determining the percentage between the same data in both conditions with the same data in conditions.

RESULTS & DISCUSSION

Based on the results of tests of mathematical reasoning ability that have been conducted by researchers on the subject for eight days, the results obtained in the baseline and intervention phases as in table 1. Table 1 shows the average acquisition value of the baseline phase of 48.75 while the intervention phase of 92, 75. The data can provide clarity and show that the treatment with problem-based learning models shows a significant increase in the subject's mathematical reasoning abilities.

Table 1. Accumulation of Test Values in Baseline and Intervention Phases

Phase	Baseline (A)				Intervention (B)			
	Sesion 1	Sesion 2	Sesion 3	Sesion 4	Sesion 1	Sesion 2	Sesion 3	Sesion 4
value	45	55	45	50	86	95	92,5	97,5
Mean	48,75				92,75			

Based on the data in table 1, to clarify the acquisition value of each phase of the data presented in graphical form as shown in Figure 2.

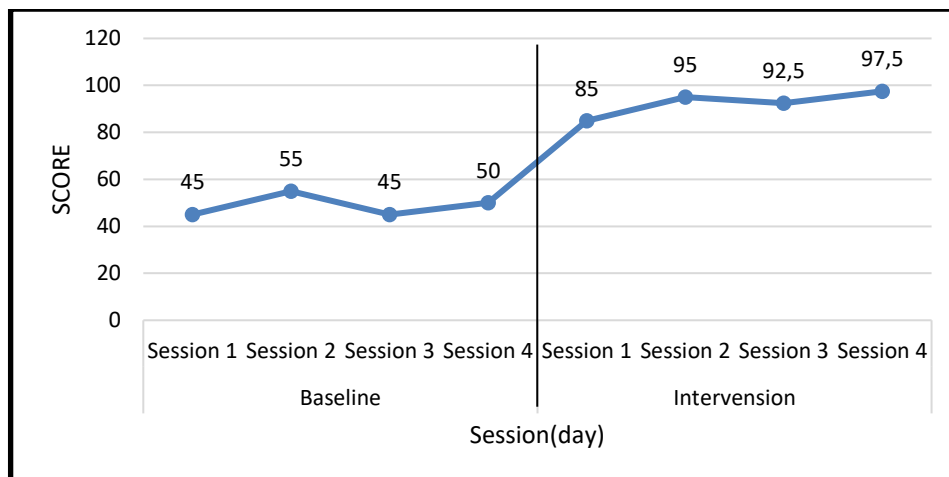


Figure 2. Comparison of Mathematical Reasoning Ability Scores in Baseline and Intervention Phases

The data collected was analyzed using analysis in conditions to determine the initial conditions of the research subjects. Components of analysis in conditions include condition length, degree of stability, direction tendency, rate of change, trace data, and range.


Table 2. Summary of Analysis Results in Conditions

Condition	Baseline (A)	Intervention (B)
Long of Condition	4	4
Toward of Trend		
Level of stability	Variable (75%)	Stabil (100%)
Level of Change	(50 – 45) (+5)	(97,5 – 86) (+11,5)
Trace of data		

Based on table 2, it is known that the length of the baseline phase condition is 4 with the intention of the baseline phase that there are four meeting sessions and intervention = 4 which means there is four treatment giving sessions. The results of the estimation of the direction tendency provide information that the tendency of the development of mathematical reasoning abilities in the baseline phase has changed and in the intervention phase also has changed/increased. The tendency for stability, for the baseline phase (A) = variable, and intervention (B) = stable. The baseline phase has a stability level of 75% which is in the range of 85% - 95% so it is said to be variable/unstable. While the intervention has a stability level of 100% which means that the level of stability tendency is stable. The data footprint tends to increase or there is a change in the intervention phase, while for the baseline phase the data footprint also increases or there is a change. The level of stability for the baseline (A) is stable with a range of 44.625 - 52.875, which means the range of data in the baseline phase is between a score of 44.625 to 52.875. The intervention phase (B) is stable with a range of 85.4375 - 100.0625, which means the range of data in this phase is between 85.4375 and 100.0625. The level of change is based on the results of the baseline phase analysis (A) = +5 which means that the data in the baseline phase changes. The intervention phase (B) = + 11.5 shows an improved condition of 11.5.

After being analyzed using an analysis of conditions, the data were analyzed using an inter-condition analysis to see the effect of the intervention given to the subject. Components of analysis between conditions include altered variables, changes in direction and effect, changes in stability and effects, changes in data levels, and overlapping data.

Table 3. Data Analysis Results Between Conditions

Comparison of conditions	Baseline (A)/Intervention (B)
Number of Variables changed	1
Change in Direction and its effect	
Change in Stability	Variable to Stable
Change in Data Level	50 – 86 (+ 36)
Overlap	0%

Based on the table above, it can be explained that the number of variables changed is one, namely students' mathematical reasoning in the baseline (A) to intervention (B) conditions. The tendency of the direction of change that occurs in the subjects studied explains that the change in trends in the baseline (A) phase with the intervention (B) is fixed and ascending, which means that in the baseline (A) phase there is no change while in the intervention phase (B) it increases. The tendency for stability in the baseline phase (A) with the intervention (B) is variable to stable. The subject's mathematical reasoning ability increased by 36 in the first session of intervention (B) from the last session of the baseline (A), this indicates an ascending or improving condition (+) after the intervention was given.

Data overlap at baseline (A) to intervention (B) that is 0. Data overlap shows that there are similarities between the baseline phases (A) and intervention (B) the smaller the percentage of overlap, the better the effect of the intervention on target behavior. between baseline (A) and intervention (B), there is no overlapping data, which means that giving intervention influences the target behavior, ie giving treatment with a problem-based learning model shows a significant increase in the ability of mathematical reasoning on the subject.

Subjects were given a mathematical reasoning ability test of 5 descriptive questions. This test is used to measure the initial ability before being treated in the form of learning by using a problem-based learning model. The results of tests of mathematical reasoning ability in the baseline phase can be seen in Figure 3.

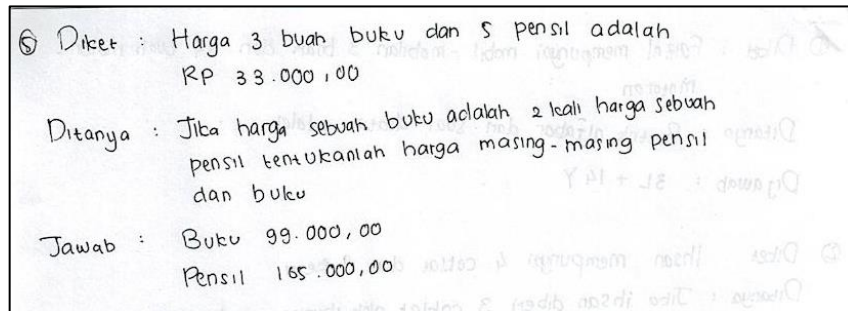


Figure 3. Completion of Baseline Phase Mathematical Reasoning Ability Tests

Based on Figure 3, the subject needs to develop mathematical reasoning abilities optimally, this is because the subject only translates the problems contained in the problem by writing down known and asked questions. While on completion or answered, the subject only writes answers directly namely "books: 99,000.00 and pencils: 165,000.00" without any way to solve them. This is in line with previous research which states that some students who can translate problems are hampered in the process of solving problems by the inability to use mathematics correctly (Crismasanti & Yuniarta, 2017; Kasriana & Ode, 2018; Sunarti, 2015; Widayanti, 2016). So the researcher concludes that the subject has not been able to submit allegations, compile evidence, give reasons for the truth of the solution to conclude the problems contained in the problem. Therefore in the intervention phase, the subject is guided to develop mathematical reasoning abilities so that several indicators of mathematical reasoning abilities can be met (Shadiq, 2004).

Whereas in the intervention phase, subjects were given learning in the form of problem-based learning models. The learning process with a problem-based learning model for introverted students, the researcher begins learning by explaining the objectives to be achieved in learning, describing, motivating the subject to be seen in activities in activities to overcome problems. Based on the problem being studied, the subject prepares the needs needed in learning, continues to make a design through real experience, then the subject identifies the problem by whatever the things that are known, are asked, and seeks solutions to problems from various sources independently. In investigating and solving problems, subjects use a lot of skills so that they are motivated to solve real problems and researchers appreciate the activities of subjects so they enjoy working together. Furthermore, the subject conveys the solution of the problem in the form of work in the form of a report and then evaluates it.

Evaluation at the end of the meeting in the form of 5 mathematical reasoning ability test questions related to daily life to measure the subject's mathematical reasoning ability after being treated using a problem-based learning model. The results obtained in this phase can be seen in Figure 4. Based on Figure 4, it is known that the subject has been able to fulfill several indicators of mathematical reasoning ability. In this phase, the subject completes the test using the method. If viewed from the way the solution is the subject can submit allegations, manipulate to conclude the settlement. So, the researcher can state that slowly the subject has developed his mathematical reasoning abilities.

5) Diketahui : Harga 2 kg tepung terigu dan 7 kg gula
 adalah Rp 96.000,00
 Ditanya : Jika harga 1 kg gula adalah 2 kali harga 1 tepung
 terigu • tentukan harga masing - masing 1 kg
 tepung terigu dan 1 kg gula
 Dijawab : Misalkan tepung terigu = t , gula = g
 $2t + 7g = 96.000$
 $2t + 7(2t) = 96.000$ $g = 2 \times t$
 $2t + 14t = 96.000$ $g = 2 \times 6.000$
 $16t = 96.000$ $g = 12.000$
 $t = 6.000$
 Jadi harga masing - masing tepung = 6.000
 gula = 12.000

Figure 4. Completion of the Intervention Phase Mathematical Reasoning Ability Test

During the intervention phase the researcher also obtained results that after the subject was given treatment in the form of learning using a problem-based learning model, the subjects seemed to be more enthusiastic in participating in learning and wanted to ask questions that were unknown or not yet understood. During the intervention phase, the teaching and learning process becomes more interactive and the subject is more enthusiastic in the learning process. Learning using problem-based learning models requires subjects known to have introverted personalities to be more courageous in expressing opinions and conveying the results of their work. This statement is in line with previous research which states that problem-based learning enables students to be more active in learning to gain knowledge in developing thinking through the presentation of problems with more real coverage, namely problems that often occur in daily life (Sufi, 2016; Sumartini, 2015). This is also in line with other research which reveals that the application of problem-based learning models can enable students to understand problems and improve the learning process so that students' mathematics learning outcomes improve (Raufany et al., 2018).

Based on the results of the study note that the learning that takes place using the Problem Based Learning model with algebraic operating material for introverted students produces learning processes that can improve the results of mathematical reasoning abilities. This is indicated by an increase in scores obtained by the subject after the intervention phase in the form of giving treatment in the form of Problem Based Learning. This statement is in line with previous research which states that the results of the evaluation before and after treatment showed a significant improvement in mathematics learning outcomes (Yanti et al., 2018).

CONCLUSION

Based on the results of the study it can be concluded that the introverted student learning process on algebraic operating material is the subject preparing the needs needed in learning, continued to make a design through real experience, then the subject identifies the problem by whatever things are known, are asked, and seeks solutions from problems from various sources independently. Furthermore, the subject conveys the solution to the problem in the form of work in the form of a report and conducts an evaluation. This study also obtained treatment results in the form of problem-based learning showed a significant increase in the mathematical reasoning ability of introverted students. The mean level of the subject from the mathematical reasoning ability test results increased from 48.75 in the baseline phase to 92.75 in the intervention phase. This is supported also by the low

percentage of overlap between the baseline conditions and the intervention of 0. These results can be concluded that the use of problem-based learning models has a positive influence on the ability of mathematical reasoning in introverted students.

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