

## Learning achievement of extroverted students in algebraic operations by tutorial learning: A single subject research

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### ABSTRACT

The purpose of this study was to improve the learning achievement of extroverted students on algebraic operations using the tutorial method. This type of research was a single subject with AB design, where A is the baseline condition, and B is an intervention condition. The research subjects were selected based on a purposive sampling technique with the help of the Keirsey Temperament Sorter (KTS) test in selecting extrovert subjects. Data collection techniques were using observation and test methods. Observation was used to collect data and record all behavior of extrovert subjects during the study. The tests in this study were the KTS and learning achievement tests. The KTS was used to determine subjects with an extroverted temperament while learning achievement tests are used to determine the ability of extrovert students to solve algebraic operation questions at the junior high school level. The results showed that the tutorial method had a positive effect on extrovert student learning achievement in algebraic operation material. This can be seen from the results of the analysis in conditions and between conditions which show that the intervention condition has a better tendency when compared to the baseline condition to the intervention. Besides that, the mean level obtained at the baseline is 50 and increases in the intervention condition with a mean level of 88.5.

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## 1. INTRODUCTION

At this time, learning mathematics requires students to be more active and creative [1]–[3]. This causes students to focus more on learning so that students can get satisfactory results in the learning process [4]. Even though each student has cognitive abilities as an outcome in different learning [5], [6]. Because the personalities of students are different so that they have different abilities in winning the knowledge provided by the teacher [7]–[9]. Where every student has different attitudes and behaviors, differences in behavior in each individual occur due to the influence of different student personalities [10], [11].

The different characteristics of students are certainly one of the obstacles for teachers in delivering subject matter [12]. The difference in learning characteristics is what makes a teacher need to be able to get to know their students better, such as habits, needs, learning styles, and choosing the right learning methods and models [13]–[16]. However, the reality at school, teachers are not yet fully able to know students so that the needs of students in learning mathematics have not been properly fulfilled [17], [18]. This is due to the heterogeneous conditions of the mathematics class, and the short learning time [19]–[21]. Even though the

concept of independent learning and servitude to students, is used as a philosophical basis by the government in this case the ministry of education, culture, research and technology to change the 2013 curriculum which has been used. Curriculum changes by taking into account the characteristics of students in the learning process are intended so that students can be served well during the learning process and students do not feel burdened by the learning targets that have been given to them.

The learning process in class is often carried out classically [5], [8]. The teacher delivers the material through lectures, sometimes even the teacher only provides examples of questions and practice questions without guiding to solve these questions, students only become listeners and tend to be passive in classroom learning activities. Whereas, so far classical learning has been given in mathematics class, the teacher during the learning process considers the condition of the students to be in the same condition, both in terms of initial abilities, learning styles, temperament and the economic background of the students' families. As we know that mathematics class comes from heterogeneous students [19], [20]. In connection with this condition, it is necessary to understand the teacher's understanding of the strategies that must be used in mathematics learning. Hence, students can understand mathematical concepts meaningfully.

Human personality is divided into two personality types based on the attitude of the human soul, they are extroverted and introverted humans [22], [23]. This human personality is a person's reaction to something, but if these reactions are carried out continuously it will turn into habits [24]–[27]. An extrovert is an attitude that directs psychic energy outward so that a person is oriented towards something objective, and away from the subjective [23], [28]–[31]. Extroverted people are more influenced by their surroundings than their inner world [26], [32]. Extroverts are characterized by an aversion to activities that take a long time and take action rather than contemplate.

Realizing the different conditions for each student, the teacher can assist students in learning and the teacher can adjust the needs desired by students. One of the characteristics of students is students with extroverted personalities [23]. Students in this category tend to open themselves too much to the outside world which is influenced by their objective world [29]–[31], tend to like to interact and socialize [26], [33]. Students with extroverted personalities will be better at learning if given guidance and direction in the learning process [34]. Therefore, extrovert students should get special attention so that their temperament or personality can be used as an advantage [28], [35], [36] so that they can be developed better. To fulfill the needs of extroverted students in learning mathematics, one of the learning methods that can be used is the tutorial method.

The tutorial method is learning in the form of academic tutoring by tutors to learning citizens to help smooth the process of independent learning for citizens to learn individually or in groups related to teaching materials [37]–[39]. In the tutorial method, students get individual learning services so that the specific problems they face can be served specifically as well [40]. Also, students can learn at a speed that suits their abilities without having to be influenced by the learning speed of other students [41]–[43].

Based on these conditions, it is necessary to take action to optimize student learning outcomes through appropriate learning methods. Therefore, it is necessary to research to see the increase in learning outcomes of students with extrovert in mathematics using appropriate learning methods. In connection with this condition, the purpose of this study is to improve the learning achievement of extrovert students by using the tutorial method on algebraic operations material. So that the basic contribution of the research is that tutorial learning can be used as an alternative learning for the rest of the extroverts, especially in algebraic material. Algebra was chosen because algebra is one of the branches of mathematics that is important to learn [44]. Also, algebra is used to change problems in everyday life into mathematical sentences [45].

## 2. RESEARCH METHOD

This was single subject research with single case experiment design. It was carried out on a single subject to know the magnitude of the effect of repeated treatment on the behavior that you want to change within a certain time [46]–[48]. This research used A-B design; where A is the baseline condition, i.e., the condition when the treatment has not been given or the initial condition. Condition B is an intervention condition, that is, the condition when an intervention has been given and the target behavior is measured under that condition. The measurement of A-B design is done in a certain period for example weekly, per day, hourly, and the comparison is not done between individuals but compared to the same subject under different conditions [47].

The research subjects were selected using a purposive technique, meaning that the research subjects had to be adjusted to the characteristics of the study, the purpose of the study, and the subjectivity of the researchers to select subjects without leaving the researchers' code of ethics [49], [50]. The research subject used was a student with an extrovert. Furthermore, according to the research code of ethics, this subject is referred to as E. To find out that students have extroverted personalities, the researchers gave personality

tests which were taken from preferences of extrovert and introverted on the Keirsey Temperament Sorter (KTS) [51], [52]. This KTS originally contained 70 items [53], but in this study, only extrovert and introvert indicators were taken so that only 10 items.

Data collection techniques in this study were carried out by using observation and tests. Observation in this study is used to observe and record all the behavior of the subject during the study. Observations were made by describing the indicators the researcher wanted to achieve. Observation indicators are: i) the subject is enthusiastic during learning; ii) the subject understands the instructions and material presented by the researcher; and iii) the subject can work on the questions given.

There are two tests used in this study, namely KTS and learning achievement tests. KTS is used to determine the research subject is in an extroverted condition. As previously written, to find out extroverted students, 10 items included in the introvert and extrovert preferences in KTS were used [51]–[53]. Learning achievement test is used by researchers to determine the ability of extroverted students in understanding algebraic operations. The test used is in the form of an essay. This test is structured by referring to the indicators of algebraic operations, namely: i) Students can recognize and operate algebraic addition and subtraction operations; ii) Students can recognize and operate algebraic multiplication operations; iii) Students can recognize and operate algebraic power operations; and iv) Students can recognize and operate algebraic division operations.

The data analysis technique used in this study includes analysis in conditions and analysis between conditions [54]. In-condition analysis is an analysis performed at baseline conditions and intervention conditions. The components used to perform the analysis in these conditions include: i) Determining the length of the condition; ii) Determining the estimation of the trend; iii) Determining the stability trend; iv) Determining the trend of the data trail; v) Determining the level of stability and range; and vi) Determine the level of change [47], [48]. An analysis between conditions was carried out to see the difference between the baseline phase and the intervention phase [54]. The components used to carry out this condition analysis include: i) Determining the number of variables changed; ii) Determining changes in trend direction; iii) Determining changes in stability trends; iv) Determining the level of change; and v) Determining the overlap of baseline conditions. and intervention [47], [48].

### 3. RESULTS AND DISCUSSION

#### 3.1. Result

The results of the KTS test found that subject E had an extrovert preference as was the goal of this study. The results of the measurement of subject E in understanding algebraic operation material during the baseline and intervention stages are presented in Figure 1. The figure shows data analysis in single subject research using analysis under conditions and techniques between conditions.

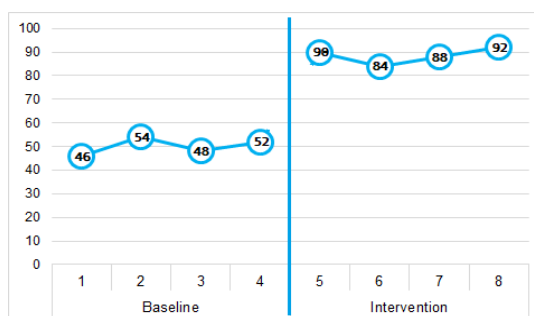


Figure 1. Score student of extrovert in baseline and intervention

#### 3.1.1. Analysis under conditions

In this analysis the steps used are: i) determining the length of the condition; i) determining the estimation of the trend; iii) determining the stability trend; iv) determining the trend of the data trail; v) determining the level of stability and range; and vi) determine the level of change. The first step is determining the length of the condition. Figure 2 shows that the baseline phase (A1) was carried out for four sessions. Likewise, the intervention phase (B1) was also carried out in four sessions. At the end of each session, a test is given to measure the extroverted students' ability to understand algebraic arithmetic operations.

The second step is determining the estimation of the trend. Estimation of the trend of the data on a graph is very important in single-subject research, it aims to provide an overview of the behavior of the subject being studied. Estimation of the trend in this study using the split-middle method [55]–[57]. This method is carried out based on the median value of the ordinal data points. The trend direction in research can be seen in Figure 2. It can be seen that the baseline phase has a constant trend direction, and in the intervention phase, there is a tendency towards an upward trend.

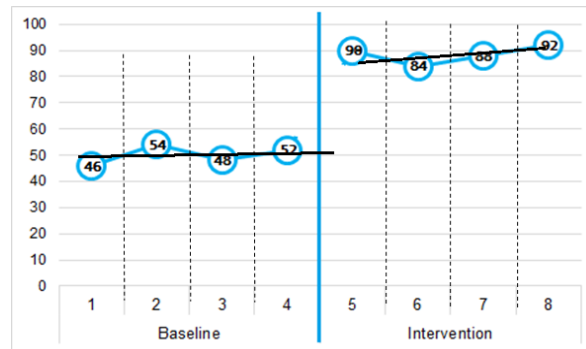


Figure 2. Estimation of the trend

The third step is determining the stability trend. The stability trend shows the degree of variation or the size of the range of certain data groups. If the data range is small or the level of variation is low, the data is said to be stable. In general, single-subject studies mostly use a stability tendency of 15%, so the calculation of the baseline conditions (A) for stability range is the high score  $\times$  stability criteria =  $52 \times 0.15 = 7.8$ . Next to determine the mean level is  $(46 + 54 + 48 + 52) : 4 = 50$ . As a result of the upper limit is mean level + half of the stability =  $50 + 3.9 = 53.9$ , and the lower limit is the mean level - half of the stability =  $50 - 3.9 = 46.1$ . From this calculation, a graph can be made as shown in Figure 3.

Furthermore, the calculation of the stability trend in the intervention phase is range is the high score  $\times$  stability criteria =  $92 \times 0.15 = 13.8$ . Next to determine the mean level is  $(90 + 84 + 88 + 92) : 4 = 88.5$ . As a result of the upper limit is mean level + half of the stability =  $88.5 + 6.9 = 95.4$ , and the lower limit is mean level - half of the stability =  $88.5 - 6.9 = 81.8$ . From this calculation, a graph was made as shown in Figure 4.

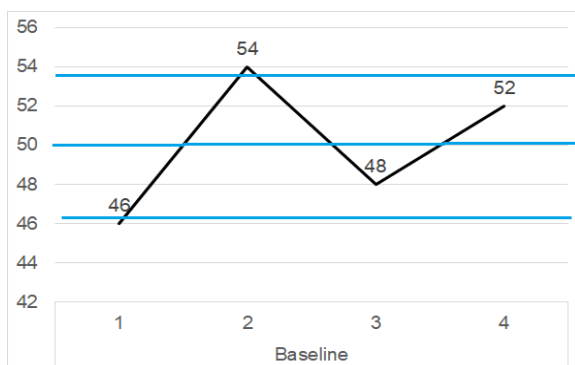


Figure 3. Determining the stability trend baseline

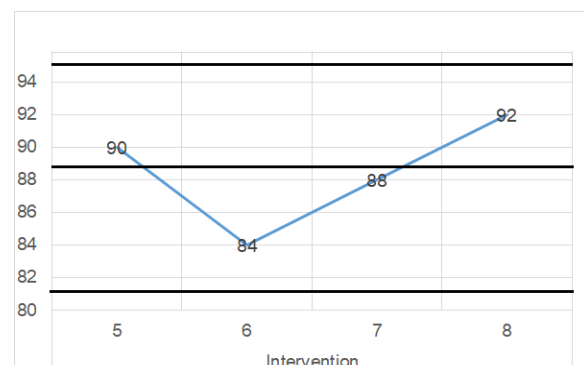


Figure 4. Determining the stability trend intervention

Based on Figures 3 and 4, it is found that the percentage trend of data point stability in the baseline phase is many data points exist in a range divided by the number of data points in other words that  $2 : 6 = 0.333$  or 33.3%. If the percentage of stability of 85% - 90% is said to be stable [58]. When it is below, it is said to be unstable (variable). Because the calculation result for the baseline phase is 33.3%, then this phase is said to be unstable (variable). This condition differs from the intervention phase with the percentage of stability is 100%, this shows that the intervention is in a stable condition.

The fourth step is to determine the trend of the data trail. To find out the trend from trail data, you can see the estimated trend direction. In the second stage, it is seen that the estimated trend towards the baseline is constant so that the trend of the data trail on the baseline is also constant. The trend estimation towards intervention seems to be increasing so that the data trail trend at the baseline also increases. The fifth step is determining the level of stability and range. To determine the level of stability and range, as previously calculated, it was found that in the baseline (A1) the data was variable or unstable with a score range between 46 and 54. In intervention (B) with a score range of 52 to 92, the data was stable.

The last step is to determine the level of change. To determine the level of change by marking the first data (day 1) and the last data (day 6) in the baseline phase (A). Then, the difference between the two data is calculated and the direction is increasing or decreasing and a sign (+) is given if it improves, (-) gets worse, and (=) if there is no change. Likewise, to calculate the level of change in the intervention phase (B). From Figure 1, it is found that in the baseline for the first day, the score was 46 and the score on the last day was 52, so the difference was (+6). In the intervention for the first day, the score was 90 and the score on the last day was 92, so the difference was (+2).

### 3.1.2. Analysis between conditions

In this analysis, the steps used are: i) determining the number of variables changed; ii) determining changes in trend direction; iii) determining changes in stability trends; iv) determining the level of change; and iv) determining the overlap of baseline conditions and intervention. The initial activity to analyze the number of variables changed in this study was to use peer tutoring techniques to improve the learning achievement of extroverted students in algebraic operations. Thus, only one variable will be changed in this study.

The second step is determining changes in trend direction. To determine changes in conditions, it can be seen in the table of changes in direction trends related to extroverted student achievement in solving algebraic operation questions as in Table 1. It can be seen that the learning achievement of extrovert students in algebra operations in the baseline phase A1 tends to be in a fixed direction (=), while in the B1 efficiency condition it tends to increase (+). In connection with this condition, it can be concluded that the provision of learning interventions using peer tutors has a positive effect on the changed variables.

The third step is determining changes in stability trends. To determine changes in stability trends, it can be seen from the stability trend in the baseline (A) and intervention (B) phases in the summary analysis under conditions. From the summary of the analysis under conditions, changes in the stability trend can be seen in Table 1.

Comparison of conditions	A/B
Changes in stability trends	Unstable to stable (Variable to stable)

The fourth step is determining the level of change. To determine the level of change, it is done by determining the data point in the baseline condition (A) in the last session, which is 52, and the first session in the intervention condition (B), which is 90. Then calculate the difference between the two, namely (52-90), so that the difference is (38). The last step is determining the overlap of baseline and intervention conditions. To determine the overlap of data at baseline conditions (A) with the intervention (B) by: i) Looking back at the lower and upper limits in the baseline conditions; ii) Calculating the number of data points in the intervention condition (B) which is in the condition range (A). After observing it, all data points in the intervention condition are not in the baseline range, so in this section, the number is 0; iii) The results obtained are divided by the number of data points in condition (B) then multiplied by 100. Since there are many data points for the intervention conditions that are not in the baseline condition, the result of this stage is 0%. In connection with this overlap percentage, the smaller the overlap percentage, the better the effect of the intervention on target behavior.

### 3.2. Discussion

Mathematics has an important role in life, in addition to functioning as a tool to solve problems, think logically, and rationally, mathematics also functions as a tool to facilitate relationships between individuals and as a tool for communication [19], [20], [59]. This is one of the reasons mathematics is given from pre-school or kindergarten to university [60], [61], this condition also applies in Indonesia. So that inevitably, students cannot avoid mathematical problems.

This study describes the condition of extroverted students from the baseline condition to the intervention condition. The test results given in the baseline for four sessions showed that the condition of subject E was in an unstable condition (variable). This can be seen from the results of determining the stability trend and the results of the calculation of the level of stability and range. The findings obtained in baseline conditions and must receive special attention include: i) The subject still has problems solving problems in algebraic operations; ii) The subject still has difficulty understanding the process of multiplying correctly; iii) The subject still has difficulty in describing and solving power problems of algebraic forms; and iv) The subject still has difficulty dividing for certain forms that have more than one variable in one tribe.

The instability in subject E needs to be given intervention so that subject E becomes stable and the subject understands the concepts that exist in mathematics. There is this research that the intervention given to subject E is learning mathematics using the tutorial method. In the intervention phase, which was carried out for four sessions, it showed that subject E was in a stable condition. This can be seen from the results of determining the stability trend and the results of the calculation of the level of stability and range which can be concluded that the subject is in a stable condition.

In addition to seeing the stability trend, level of stability, and range in subject E, learning mathematics using the tutorial method is considered successful, it can be seen in the results of the analysis between the conditions obtained that the level of change is (-38), this shows that the use of the tutorial method has a significant effect. Positive on the learning achievement of algebraic operations. So that in general subject E with extroverted temperament conditions can recognize and operate algebraic addition and subtraction operations, recognize and operate algebraic multiplication operations, recognize and operate algebraic power operations, and recognize and operate algebraic division operations.

The results of this study indicate that the provision of intervention through the tutorial learning method can improve learning outcomes for extroverted subjects, especially in algebraic operations. In tutorial learning, students are given learning guidance in the form of giving directions, assistance, instructions, and motivation so that students learn efficiently and effectively [62]–[64]. Directions in tutorial learning can be interpreted as directions given to students to achieve their respective goals (in this case, learning objectives). Assistance in tutorial learning can be interpreted by helping students learn the subject matter. Instructions in tutorial learning are providing information about how to study the material, while motivation in tutorial learning is carried out by moving students' activities in learning material, doing assignments, and taking assessments.

Peers can guide tutorial learning [65]–[67]. Teachers can become tutors for students if students are deemed not yet worthy to deliver the material to be reported. This guidance process makes the closeness between students and tutors can be formed so that students can freely ask questions directly to the tutor. With this condition, the learning atmosphere becomes alive due to active learning interactions, and the mathematics material delivered by the tutor to students becomes more meaningful.

Characteristics of extrovert students who have to read questions or read material more than once so that extrovert students understand better what is being learned [68], [69]. Also, extroverted students who are always in a hurry to solve problems are very prone to make mistakes in solving problems [70]. This is very different from introverted students who tend to be able to manage the information they face [69], [71]. The condition of extrovert students, if not given a tutor or supervisor, can result in the process of learning mathematics being hampered because extrovert students have a long tendency to understand mathematics material because the process of reading material must be done repeatedly, reading mathematical problems that must be done repeatedly, and students extroverts are prone to mistakes.

#### 4. CONCLUSION

This study concluded that tutorial learning affects extrovert student learning achievement in algebraic operation material. The effect of tutorial learning can be seen from the change in data from the baseline phase to the intervention phase. In the algebra operation test on the baseline conditions, the subject obtained an average score of 50. While in the intervention phase the subject experienced a change in the average score to 88.5. From these data, it can be seen that the learning achievement of extroverted students has changed by 38.5. With the results of this study, it is suggested that the use of tutorial learning can be used as an alternative learning method for extrovert students. Furthermore, it is necessary to pay attention to the use of learning tutorials to improve extrovert students' abilities in other materials.

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