Slope and Equation of Line: Teach and Analysis in Terms of Emotional Intelligence

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Abstract. Slope and equation of line is a sub-material of algebra and is one that is difficult for students to understand. The purpose of this study is to understand and explore the slope and equation so that students feel easy and ultimately improve their academic achievement. Experimental research was conducted by applying Jigsaw II learning model and Teams Games Tournament (TGT) and improvement in emotional intelligence (EI). The study sample was students from 3 different schools who were selected stratified cluster random sampling. The results showed that there is no influence of learning model and EI on academic achievement. This can happen even in the learning process students feel happy and interest. Although research shows different results with most theories, but it is expected that this research can be a good reference for students, teachers, and other researchers.

1. Introduction

Much of research on mathematics that have done well. This does not necessarily make the math out discussed, it makes math growing and interesting to be studied. Mathematics has a wide scope, one of which is algebra. Algebra is a common form of arithmetic in which the letters or notations used represent the numbers based on operations and rules in arithmetic [1]. Algebra is a branch of mathematics that contributes greatly to the development of the modern era [2]. It is therefore necessary for us to appreciate and understand Algebra for its development to this day.

Algebra encompasses many materials, some of which are equations. The equation itself consists of small parts such as linear equations, equations of two variables, straight-line equations, polynomial equations, differential equations, etc. Among these materials there are easy and some are difficult to learn. There are materials taught in junior high schools and some are taught at universities. Some of the material available, not only taught to students majoring in mathematics but in other majors that use mathematics as the basis of its development.

The equation of a straight line is a small part of Algebra. The material encompasses the definition of lines, the general form of the line equation, the slope of the line, the parallel and perpendicular lines, and solves the problem of straight-line equations. In Indonesia, this material is taught to junior high school students. In accordance with the applicable curriculum in 2015, the equation of straight-line equations belonging to the standard of competence understands algebraic forms, relations, functions, and equations of straight lines [3].

Through the national examination conducted by the government, an analysis of students' answers is performed. The results of analysis released by BNSP (jangan disingkat, dijelaskan lembaga apa) for
slope and straight line equations material show that the percentage of mastery of the material is low. Recorded 55.39% students' mastery of slope material and equation of national straight line. While the mastery of the material for Boyolali region only amounted to 32.50% [4]. The percentage indicates how weak the students in understanding the material. This is getting worse considering algebra is a branch of mathematics that is important to learn. Given current algebraic developments, improvement efforts need to be made. This is done to improve students' understanding of tilt material and straight line equations that appear on their academic achievement.

There are several factors that cause student achievement, one of them is learning process in school. The learning process in school is closely related to the teacher's planned learning. Efforts that can be done in improving student academic achievement is to use innovation in learning. Various innovations can be done by teachers, one of which is using a model of learning that is more interesting and pleasing to the students. Two of the existing learning models are Jigsaw II and Teams Games Tournament (TGT).

Based on the Evcim and İpek research on English prep classes. The results obtained in the form of differences in academic achievement that is significant between a class given Jigsaw II learning with a class that does not use it [5]. This means learning, in this case is Jigsaw II, has an effect on student achievement. This research is specialized in English prep classes but it does not close the possibility of obtaining the same results in the class and other learning materials.

Another similar study was conducted by Demir at the university. His research is more on evaluating the learning that is applied, namely Jigsaw II. His research results show that learning with Jigsaw II combined with creative drama can make students feel happy. Students experience different learning compared to learning in general [6]. It comes from reports and opinions of students about the learning he felt with Jigsaw II combined with creative drama.

Similar results were obtained by Wodaski, Adelson, Todd, and Wodasky in his research on elementary and high school students. The conclusions he obtained after providing nutritional material were enthusiastic students during the learning with TGT. There is a significant increase in knowledge about nutrition in each class [7]. This increase of knowledge will also improve students' academic achievement. It can be said that TGT learning not only makes students enthusiastic but also improves students' academic achievement.

Positive results on TGT were also shown in the Veloo and Chairhany studies. More in-depth research is done not only to see the influence of TGT in the students' academic achievement but also on their attitude. The results obtained a significant difference in student attitudes and achievements [8]. TGT learning is considered capable of creating an active learning environment that supports the learning process. Good learning process is what ultimately supports student academic achievement.

On the other hand, the low mathematical mastery of slope and straight line equations material is also influenced by the students themselves. Many factors can affect students themselves, one of which is emotional intelligence (EI). EI affects people in managing their feelings and others. This is evidenced by the many studies that have been done in observing EI and its effects on academic achievement.

Research conducted by Garg, Levin and Trembay observed about EI and parenting patterns in the university students. Emotional intelligence of students and authoritative parenting style can help students in adjusting themselves at the university. This certainly affects also on their academic achievement [9]. Students get academic achievement after learning only. That is, emotional intelligence also affects during learning. Students with high emotional intelligence will be more adaptable in the new environment. This is because they more easily understand the environment and adjust themselves to their attitudes, behaviors, feelings, and thoughts. This condition does not close the possibility to students in other education levels.

Emotional intelligence is an important ability to have students, especially in adolescents aged 11 years. Further research on emotional intelligence in adolescents is done by Qualter, Gardner, Pope, Hutchinson and Whiteley. Their research shows that emotional intelligence affects the cognitive abilities of 11-year-olds [10]. This cognitive ability is apparent in student performance at school. The
importance of emotional intelligence in improving students’ cognitive abilities can be a concern for educators. Through learning based on students’ emotional intelligence, students’ cognitive abilities increase.

Students have different characteristics from one another. A deep understanding of the characteristics will help the teacher in seeking maximum learning. One such characteristic is gender. Schools (except for special schools) have students of both male and female sex. The number of male and female students in a class tends to vary. Clarke, Marks, and Lykins examines the effect of gender on emotional intelligence. Their result shown, gender differences do not affect emotional intelligence [11]. So that the characteristics of gender can be ignored in its influence with student academic achievement.

Much research has been done on mathematics. Nevertheless the problems and conclusions given can not necessarily be applied. The issues discussed tend to focus on regional issues only, so there is no solution to overcome this problem. Existing research has become a reference for us, but our research is different from existing research. Our research refers to slope and straight-line equations and the application of learning models (Jigsaw II and TGT) in schools. The results were then reviewed through the students’ EI. We try to use learning models and emotional intelligence in observing academic achievement. Research on this subject has never been done before and it is a genuine experimental researcher based on existing references.

1.1. Equation of Straigh-Line and Slope
The graph of an equation is a set of points corresponding to each and each one satisfying the equation [12]. Equation of line is a form of equation of a set of points forming a straight line. The general form of the straight-line equation can be seen in Equation 1.

\[ Ax + By + C = 0 \]  
Equation 1
Where A, B, and C on equation 1 are real numbers. Through an equation, it will be able to find the points that pass. By contrast, through at least two points, an equation can be determined. If looking for the point through which the equation will be done with Equation 1, then to determine the equation of the line from two points can use Equation 2.

\[ (x - x_1)(y_2 - y_1) = (y - y_1)(x_2 - x_1) \]  
Equation 2
Where \((x_1, y_1)\) and \((x_2, y_2)\) is the point coordinates it passes.

Each line has a slope. The slope is the ratio or the ratio of changes y to the change of x [13]. The notation representing the slope is \(m\). The slope can be calculated by determining the two points of the line or the equation of the line. If two points of the line are known, then the slope of a line can be determined using Equation 3.

\[ m = \frac{\text{change in } y}{\text{change in } x} = \frac{\Delta y}{\Delta x} \]  
Equation 3
Notation \(\Delta\) is called delta. Delta refers to the magnitude of change, in this case the change \(x (\Delta x)\) and change y \(\Delta y\). The slope as seen from the equation, then the general form will be like in Equation 4.

\[ y = mx + c \]  
Equation 4
Notation \(c\) is the ordinate from the point of intersection of the line against the Y axis.

Drawing lines in Cartesian diagram, it will apply the definition of geometry. The lines on the plane definitely meet exactly one state i.e. parallel or crossed. Intersect alone will be said to be perpendicular or intersect. The line is said to be parallel or perpendicular can be seen through the slope. If both lines have the same slope then the two lines are said to be parallel. However, if the product of the slope of the two lines is -1 then it is said to be perpendicular.

1.2. Equation of Line and Slope at school
Slope and straight line equations material in Indonesia at secondary school students. This material is given in the first semester of Grade 8. To be able to learn this material of course there is a prerequisite material that must be learned first. Prerequisite materials include understanding algebraic forms, equations and linear inequalities of one variable and using algebraic forms, equations and linear inequalities of one variable, and comparison in problem solving [3]. Prerequisite material has been
taught in grade 7. Through these prerequisite materials, students will more easily recognize and understand the equation of straight-line equations.

Slope material and straight line equations in junior high school have material restrictions. The material is limited in accordance with the competency standards issued by the government. The equations of straight-line equations taught to students include only the general form of straight-line equations, drawing graphs of straight-line equations, parallel and perpendicular lines, and their applications in life. While the tilt material is only limited to the slope of a straight line. This limitation is done so that learning is more focused and the students have no difficulty in understanding.

1.3. Teach equation of Line and Slope
Slope and straight line equations take up a lot of study time in school. This is because algebra is an abstract branch of mathematics. Therefore need tools for teaching this material in class. The tools used are learning materials and worksheets adapted to the learning model. However, learning materials and worksheets are not the only source of student learning. The material created is divided into 3 small items in order to facilitate the students. The first material is drawing lines on cartesian coordinates and recognizing the equations of straight lines. The second material recognizes the slope of a line and recognizes the parallel and perpendicular lines. The last is to solve problems related to straight-line equations, gradients, parallel lines, and perpendicular lines. Each material is given in 4 lesson hours so that a total of 12 hours of lesson to complete the material.

The learning model used is Jigsaw II and TGT. There are differences in learning materials and worksheets, but the practice questions are entirely the same. What is different is simply the way of delivering the tasks and forms of the assigned tasks. If Jigsaw II is more about being done individually or in groups then TGT is more about being used as games. This is tailored to the steps of each learning model.

The learning model using Jigsaw II consists of 8 phases to be followed. The eight phases are grouping students, grouping students into experts teams, determine initial scores, reads, expert group discussions, team reports, test and team recognition [14]. If you look at the existing phase then the students will be more discussion and working on the problem independently. Students can work on the questions that are available when following a group discussion well. Discussions are also followed by working on problems in groups, this is to ensure that students have discussed and shared the knowledge they learned. The phase is repeated until the material is made up.

The learning model using TGT follows Huda's steps, namely group, tournament, scoring [15]. The learning model using TGT only uses one discussion for each material. But more time is used for games. Games in the form of similar problems but adapted to the level of student ability. Problems used in the same game with the problem used for Jigsaw II, but the number more. Problem cards and assessment sheets are provided in each group of tournaments. Students are given the confidence to perform games with the rules in force.

Learning with Jigsaw II and TGT ends with tests to see students' ability after learning. The test includes 3 items that have been given thoroughly. Tests are also done on different days with the giving of materials.

1.4. Emotional Intelligence
Emotional Intelligence (EI) is the ability to seek, understand, and manage the feelings and moods of oneself or others [16]. Those who can manage themselves and others, can be used to achieve the expected goals. Same with students, those with high emotional intelligence will be able to control their feelings. Students will not be too sad when they fail the test. Feelings of sadness so do not develop the spirit of learning. Checa & Berrocal proved from his research on undergraduate students. The result of his research is that people who show good emotional influence will be less impulsive when respondents are given cognitive task [17].

Based on theories and studies that have shown EI on student achievement. Characteristics of emotional intelligence that is can mingle with others in one group, being comfortable with self and the
realization of self potential, be more assertive about being aggressive, emotional control and control, understand the impact of attitudes and reflect on this attitude, empathize with others [18]. Yeung proposed different things that propose three EI domains are arranged in a hierarchy. Running from the bottom is self-awareness, self-direction, and interpersonal intelligence [19]. The characteristic of EI used in this research is according to Salovery & Mayer [20]. There are four basic aspects of EI: emotional recognition, emotion understanding, emotional setting, and emotional usage.

2. Experimental Method
The study was conducted with a population of grade 8 junior high school students in the district of Boyolali. School of the sample was determined by cluster stratified random sampling. Selected three schools that represent the population at random. Similarly randomly selected two classes in each school. Both of these classes are given learning model Jigsaw II and TGT. The study was conducted from July 2016 to December 2016. Implementation begins by first developing a lesson plan, learning materials, test questions, and EI instruments to be used. It aims to be more practical and focused later on in learning.

Learning steps of each model was developed based on the current syntax. The phases contained in the model jigsaw II is dividing students into teams, divide the students into groups of experts, scoring early, reading, discussion group of experts, the team reports, test and team recognition [14]. Steps in TGT model that group, tournaments and scoring [15]. Phase and existing measures are developed and adapted so that it can be implemented in the classroom.

A questionnaire sheet The EI and tests used are hand made. A statement in questionnaire made on the development aspects and indicators that exist. Internal validation and internal consistency are performed to obtain a good questionnaire. Similar to questionnaires, tests are also tested for different power, level of difficulty, and reliability. Previously has been tested the content validity by way of expert judgment. Finally obtained 40 items of questionnaires and 25 test items.

The analysis is done with Excel tool to student achievement data. This data obtained through this test data obtained through tests that have been tested beforehand that have been tested beforehand. Data mathematics achievement of students before the study is used to test the balance. Balance test using one way analysis of variance.

Furthermore, the normality test and homogeneity test were performed. Normality test using Liliefors method while homogeneity test using Bartlett test. Next will be tested hypothesis used two-way analysis of variance with different cells. Data from questionnaire only used to categorize student achievement into EI categories of high, medium, and low.

3. Result and Discussion
Balance test used one-way analysis of variance has been done. The result is the data before giving treatment was balance. So, the analysis continued. Before testing the hypothesis used two-way analysis of variance with different cells, normality and homogeneity must be requirement. Normality calculations conducted on the mathematics achievement of students. The data obtained after the treatment is given. The method used in the calculation is the method Liliefors.

Table 1. The Normality of Student Achievement

| Population                              | L    | Lα    | Decision |
|-----------------------------------------|------|-------|----------|
| Student with jigsaw II                 | 0.09090 | 0.08778 | Normal   |
| Student with TGT                       | 0.09043 | 0.08705 | Normal   |
| Student categorized as high EI         | 0.11735 | 0.10101 | Normal   |
| Student categorized as medium EI       | 0.10032 | 0.07478 | Normal   |
| Student categorized as low EI          | 0.11839 | 0.07640 | Normal   |

The result is shown in Table 1. Based on the result, the L value on each population is less than each their Lα value. This is meant each population has a normal distribution, so the analysis is continued.
Homogeneity testing is done twice. First, homogeneity performed in populations of students categorized based on learning models. Second, homogeneity done on the student population categorized by category EI. Calculations were performed using chi-square, and the result is shown in Table 1.

Table 2. The Homogeneity of Student Achievement

| Population                              | $X^2$    | $X^2\alpha$ | Decision   |
|-----------------------------------------|----------|-------------|------------|
| Student categorized based on learning models | 0.3841   | 3.841       | Homogeneity|
| Student categorized based on EI classification | 1.2222   | 5.991       | Homogeneity|

Table 2 shown that chi-square value by calculation is smaller than chi-square by table. It is mean that data is homogeneity, so the analysis is continued.

Table 2 shown that chi-square value by calculation is smaller than chi-square by table. It is mean that data is homogeneity, so the analysis is continued.

There are two independent variables, it is learning models and EI. Analysis is continued using 2x3 sized covariance analysis with difference number of cells. Summary of the result is shown in Table 3.

Table 3. The Hypothesis test

| Source         | JK   | Dk  | F      | $F_{\alpha}$ | Result      |
|----------------|------|-----|--------|--------------|-------------|
| Learning Models| 38.1009 | 1   | 1.80717| 3.84         | No effect   |
| EI             | 23.799| 2   | 0.56441| 3            | No effect   |
| Interaction    | 65.7914| 2   | 1.56028| 3            | No interaction|
| Galat          | 3990.39 | 185 |        |              |             |

Tests showed that the F value of learning models, EI, and interaction is less than each $F_{\alpha}$. This means there is no influence between the learning model of learning achievement, there is no influence of EI on learning achievement, and there is no interaction between learning models and EI on learning achievement. The results of this study are in line with Savelsbergh, Prins, Rietbergen, Fechner, Vaessen, Draijer, and Bakker which show no significant improvement despite the positive response from students [21].

4. Conclusion
Mathematics achievement of students is influenced by many things. Two of them are learning model and EI. Some research conclude that learning model and EI contribute on mathematics achievement. Nevertheless, the analysis of both in this research showed that the learning model and EI does not affect students mathematics achievement. Based on Table 4, shown for learning models and EI source their result is no effect. This means learning models has not influence to mathematics achievement student. Same result for EI, that means EI has no influence to mathematics achievement student. On interaction source, column result shown no interaction. This means that interaction between learning models and EI has not influence to mathematics achievement student.

This research limited to sub material gradients and straight line equation. This limited can help researcher to focused on teaching. On the other hand, these restrictions can limit the result only on the sub material. These result can not be standarization for another research in different material but can be reference for better research. This reseach is open to discuss. New research can be build from this.

New researcher should also concern about time learning. Limited time teaching at school can be troublesome. Time management needed to execute this learning model. School schedule must be concern, so research planing can continue without hesitation.

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