Digital peer tutoring in engineering education

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Abstract. The learning process is one of determinant of the quality of student learning outcomes. One of the problems that often occurs in the learning process is inadequate teacher’s teaching strategies, particularly in Engineering Drawing subjects. The teacher tends to be less creative, less variative and trapped in a rigid learning process. These conditions make them less active and feel bored during the learning process. This research aims to know whether there are any differences between the aspects of activeness and psychomotor learning outcomes of the students through the implementation of Peer Tutoring and Learning Together learning methods in the Engineering Drawing subject. The population of this research is the students of class X DPIB in SMKN 5 Bandung while the samples consist of two classes that are selected using purposive sampling technique. The research instruments are observation sheet of student activeness and drawing skills assessment. After implementing Peer Tutoring learning method in class X DPIB 1, the students get 86.81 as the average score in drawing result and they are more active in some indicators such as Drawing activities, Motor activities, Mental activities, and Emotional activities. Meanwhile after implementing Learning Together learning method in class X DPIB 4, the students get 74.23 as the average score in drawing result and they are more active in some indicators such as Visual activities, Oral activities, listening activities, and Writing activities. This research data is analyzed by statistics Independent T-test. The analysis results show that there are differences between the aspects of activeness and psychomotor learning outcomes of the students who use Peer Tutoring learning method and the students who use Learning Together learning method in the Engineering Drawing subjects.

1. Introduction
The 2013 curriculum learning require. Therefore, the learning strategies used can provide learning experiences that can develop students’ potential. The teacher plays as a guide facilitating the achievement of competencies that have been designed in the curriculum document. The 2013 curriculum demands the quality of learning that can make students active in the learning process. Thus, teachers are required to be creative and innovative in designing learning so students are motivated and excited during the learning process.

Technical Drawing is a basic lesson to learn drawing techniques obtained during 2 semesters in class X SMK DPIB and is a productive subject that must be followed by students. Skills in Technical Drawing are needed such as making 2D orthogonal projections, making 3D pictorial projections, and making the results of image pieces and others. Therefore, this subject is one of the subjects that has quite a lot of material in the form of theory and practice. This much material coverage should ideally be given more learning time, so that the material can be delivered as intended. From the results of the initial interview with the teacher, that the teacher felt the learning time in this subject was still insufficient to meet the
achievement of good student learning outcomes, students’ skills in utilizing drawing tools were still lacking, and some students were still reluctant to ask the teacher, so the teacher still often find students who lack motivation to learn and tend to wait for the results of the picture from their friends who have finished when the learning process takes place. To work around this, teachers must be creative and innovative in the learning process, one of which is in the selection of learning methods, the success of the implementation of learning is very dependent on the way the teacher uses the learning method [1]. This is in line with Sugihartono which states that the learning method is a method used in the learning process to obtain optimal results [2]. The teacher must have creativity in choosing learning methods, so students become active in the learning process.

Based on these problems, the approach to learning methods that are more oriented to students (student center) needs to be tested [3]. Peer Tutoring method is a method that requires students to actively discuss with fellow peers, or do group work with guidance or the direction of competent friends, while the Learning Together type of learning together has the characteristics of face-to-face interaction, positive interdependence, individual responsibility, interpersonal abilities, and small groups [4]. One of the efforts made is to try to use the method of peer tutoring and learning together in Technical Drawing subjects which are productive subjects, these methods can be applied in an effort to improve student activity and learning outcomes.

When students actively participate in the learning process so that learning outcomes become in line with learning objectives. Learning outcomes are the abilities possessed by students after receiving their learning experience, someone who has learned there will be changes in behavior in that person, for example from not knowing to knowing, from not understanding to understanding [5]. Researchers chose to use the method of peer tutoring and learning together because this is in accordance with the needs and characteristics of subjects to improve student activity and learning outcomes. In learning activities, it is highly demanded that students are active in achieving learning outcomes that are in accordance with the objectives, where students are subjects who do a lot of activities, while teachers guide and direct more. Through this method of peer tutoring and learning together, students are expected to be able to realize and develop their potential in understanding material in Technical Drawing subjects, namely how to draw well and correctly [6].

The application of peer tutoring and learning together can be applied to Technical Drawing subjects by forming groups so students can complete their assignments properly and correctly. Therefore, researchers raised the problem in a study entitled "Comparison of the Application of Peer Tutoring Learning Methods with Learning Together in the Active Aspects and Students' Psychomotor Learning Outcomes in Technical Drawing Subjects".

2. Method
The research method used in this study is an experimental research method. Experimental has treatment [7], thus the experimental research method can be interpreted as a research method used to look for the effect of certain treatments on others under controlled conditions. The research design used is a Pre-Experimental research design, the type of research used in this study is the One-Shot Case Study. The study was conducted in two experimental classes, the research took place four meetings in each class. The instrument used was an active observation sheet with eight indicators of student activity i.e. Visual activities, Oral activities, listening activities, writing activities, Drawing activities, Motor activities, Mental activities, and Emotional activities. and skills assessment instruments [2]. To analyze the results of active observations, a percentage is made in a way

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\% = \frac{\text{Amount obtained}}{\text{Maximum Amount}} \times 100\% \tag{1}
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psychomotor learning outcomes tested with the Independent T-test hypothesis test. The Hypothesis for this study is:
Ha: “There are differences in Psychomotor Learning Outcomes between class students who use peer tutoring learning methods and classes that use learning together learning methods in Technical Drawing subjects.”

3. Result and discussion

Based on valid data obtained there are two instruments, namely the results of active observations and psychomotor student learning outcomes can be seen in the comparison of the implementation of the Peer Tutoring learning method with Learning Together as follows. In the class results using the Learning Together learning method, there were 10 students who did not graduate, with a percentage of 27.78% and many students who passed, 26 with a percentage of 72.22%, while in the class drawing results using the Peer learning method. Tutoring many students who did not pass are 4 people with a percentage of 11.11% and many students who graduated are 32 people with a percentage of 88.89%.

Based on figure 1, the difference in the acquisition of the average score of the images in the two experimental classes with each value in the class using the peer tutoring learning method of 86.81 while in class using the learning together learning method obtained a value of 74.23.

The Hypothesis Test used in this study is the Independent T-test to test whether there are differences in results between the Peer Tutoring learning methods and Learning Together. Hypothesis test results processed with the help of the SPSS v.25.0 program produce the following data:

| Levene's Test for Equality of Variances | t-test for Equality of Means |
|----------------------------------------|-----------------------------|
| F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |
|---|-----|---|----|-----------------|-----------------|----------------------|----------------------------------------|
| 30.518 | .000 | 2.809 | 70 | .006 | 12.57778 | 4.47835 | 3.64599 | 21.50956 |

According to the results of the Independent T-test in table 1 obtained sig. 0.006 and 0.007 because sig 0.006 and 0.007 are smaller than 0.05 then H0 is rejected. Therefore, it can be concluded that there are differences in Psychomotor Learning Outcomes between class students who use peer tutoring learning methods and classes that use learning together learning methods in Technical Drawing lessons.

The learning outcomes studied in this study are in the form of image results (psychomotor) because these Technical Drawing subjects are productive subjects. There is an increase in the average value of the two classes before being treated with the Peer Tutoring and Learning Together learning methods, if in class X DPIB 1 the average value of the class is 65.41 and in class X DPIB 4 is 61.80 that value based on the results of the Technical Drawing subject teachers before the research took place and still using confessional learning methods. Then the comparison at the time of the study, students work on drawing assignments (Pieces) for four meetings with treatment of different learning methods, if in class X DPIB 1 is treated with the Peer Tutoring learning method and if class X DPIB 4 is treated with the Learning Together learning method, and at the end of the study or at the fourth meeting the tasks of the drawing
are collected. The acquisition of average score data in the class using the Peer Tutoring learning method is superior to the acquisition of a score of 86.81 of the maximum score of 100 while the acquisition of the average score of data in the class with the Learning Together learning method of 74.23 of the maximum score of 100.

The Peer Tutoring learning method provides convenience for students because students do not feel ashamed and are reluctant to ask tutors if during the learning process experiences difficulties and lack understanding of the steps to draw pieces, in addition tutors feel helped by other students if there are also in the group students who easily understand learning so that it can explain back to other students who do not understand. Peers greatly affect student learning success because of the openness, interdependence, and positive competition between them [8].

The results of student activeness examined in this study were observations of student activity, there were eight indicators of student activity according to Sardiman, Visual activities, Oral activities, listening activities, writing activities, Drawing activities, Motor activities, Mental activities, and Emotional activities [9]. This research was conducted on Technical Drawing subjects which are productive subjects that are not only theoretical in the delivery of material but also with practice, because with that in these subjects needed more activity than subjects that only convey the theory in the learning process, research this was done in two different classes with different learning methods as well, these observations were made during four meetings with treatment of different learning methods, if in class X DPIB 1 were treated with the Peer Tutoring learning method and if class X DPIB 4 were treated with the Learning Together learning method. From the observations of each indicator has a different result.

| Indicator          | Peer Tutoring | Learning Together |
|--------------------|---------------|-------------------|
| Visual activities  | 56.94%        | 73.61%            |
| Oral activities    | 47.22%        | 55.56%            |
| Listening activities| 61.80%       | 84.02%            |
| Writing activities | 61.11%        | 69.44%            |
| Drawing activities | 72.91%        | 59.02%            |
| Motor activities   | 69.44%        | 60.41%            |
| Mental activities  | 73.61%        | 61.11%            |
| Emotional activities| 80.56%      | 61.11%            |

The difference between the two methods, as seen in the data in table 2, shows a balanced proportion in achieving indicators of student activity in the classroom. Peer Tutoring learning methods are better on four indicators of activity, namely Drawing activities, Motor activities, Mental activities, and Emotional activities. Meanwhile Learning Together learning method is better on four indicators of activity, namely: Visual activities, Oral activities, Listening activities, and Writing activities.

There are two external factors, namely social and environmental factors that make students using the Learning Together learning method more active on the Visual activities indicator, Oral activities, Listening activities, and Writing activities, because there is no tutor who is responsible for learning together in the learning method. to re-explain the material or drawing steps that have been explained by the teacher, so that students with the learning method Learning Together more actively take notes, pay attention, and ask the teacher when the teacher is explaining that they feel more responsible towards themselves so that students Learning methods in Learning Together are more active on indicators of Visual activities, Oral activities, Listening activities, and Writing activities. In contrast to students using the Peer Tutoring learning method more actively on indicators Drawing activities, Motor activities, Mental activities, and Emotional activities, because in the group there is one tutor who is given more responsibility by the teacher to deliver the material or explain the steps that are has been explained by the teacher to their peers so that the results of drawing students with the Peer Tutoring method are better than the Learning Together learning method, because they are more flexible and are not reluctant to ask their peer tutors and make them more enthusiastic in the learning process.
The activity can be increased and improved in student involvement when learning. This is as explained by Usman ways to improve student involvement including capturing more time for teaching and learning activities, increasing student participation effectively in teaching and learning activities, and providing clear and appropriate teaching in accordance with the objectives teaching to be achieved [10]. In addition to improving student friendliness, it is also explained how to increase student involvement or student activity in learning. In this case the involvement of students in the learning process can affect the results of student activity in the classroom, directly proportional to the two methods of Peer Tutoring and Learning Together which makes the center of learning resides with students no longer on the teacher, with both methods very suitable to be used to increase student activity in the classroom.

4. Conclusion

Based on the analysis and discussion of research Comparative Learning Guidance Learning Method with Collaborative Learning Against the Aspect of Student Psychomotor Activity and Learning Outcomes in Technical Drawing Subjects, the results of this study are obtained as follows:

- There are differences in student activity between those who use the Peer Tutoring learning method and the class that uses the Learning Together learning method in Technical Drawing subjects.
- There are differences in students' psychomotor learning outcomes between those who use the Peer Tutoring learning method and the classes that use the Learning Together learning method in Technical Drawing subjects.
- Peer Tutoring learning methods are better at activeness in the indicators Drawing, Motor activities, Mental activities, and Emotional activities.
- Learning Together Learning methods are better at activeness in the Visual activities indicator, Oral activities, Listening activities, and Writing activities.
- Appropriate teaching methods to improve learning outcomes Technical Drawing is a Peer Tutoring learning method.

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