Enhancing of Student Involvement and Collaboration through Think-Pair-Share Model on Energy Conversion Learning

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Abstract

This study aims to improve collaboration in thinking, pairing, and sharing of students in energy conversion learning. This study experimented with the think pair and share (TPS) type of cooperative method to get improvements in terms of activity and cooperation. The procedure of the study adopted the classroom action research of the Kemmis & Taggart model covering the stages of planning, implementation, observation and reflection. Data collection techniques using observation and documentation. The results showed that the application of the cooperative learning model type TPS method was able to increase collaboration in thinking, pairing, and sharing as evidenced by the results of observations of each cycle which increased the first cycle of 12.5% for student involvement and 25% for collaboration, the second cycle of 78,1% for student involvement and 53.1% for cooperation, and third cycle of 96.9% for student involvement and 100% for cooperation. It shows that the application of TPS is useful to be applied in energy conversion learning. Also, this research may need to be continued in other engineering courses which are dominated by theory and practicum.

Keywords: thinking, pairing, sharing, student involvement, collaboration, energy conversion learning

1. Introduction

Education is a conscious and planned way to create an atmosphere of learning and learning process so that students actively develop their potential to have spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by themselves, society, nation and state (Indonesia Law, 2003). The achievement of learning objectives or teaching outcomes is greatly influenced by how students' activities in learning (Hsu & Chen, 2010; Rabiman, et'al 2020). The success of learning can be seen from the activities or activities of students in participating in the learning, the higher the activity of student activities in learning, the higher the level of learning success (Biggs, 1999; Pusca & Northwood, 2017). However, to get the success of learning is not an easy thing; it takes effort from various parties to achieve it. Besides, the success of the teaching and learning process must also be supported by the selection of appropriate learning methods.

Based on the results of observations and learning of energy conversion in the Department of Mechanical Engineering Education, Universitas Negeri Yogyakarta, it was found that many lecturers still use cooperative learning models with discussion methods with an implementation that is not yet optimal. This suboptimal can be indicated by the existence of students who pay less attention when the lecturer gives an introduction to practical learning. Student enthusiasm in participating in learning is still lacking. Students tend to be less active and less interacting with other students. As for students who are active in discussions but tend to be crowded, which widens the topic of learning material. Not all students actively ask questions; only a few dare to ask questions and actively discuss. This can result in a non-conducive learning atmosphere in the classroom if the lecturer is less involved.

Lecturers have an important role in managing the learning process so that it remains conducive when learning takes place (Setiadi, Suparmin, & Samidjo, 2018). The lack of variations implemented in learning, such as the application of learning models and the use of media affect the activeness and motivation of learning to impact on optimal learning (Setuju, Ratnawati, Wijayanti, Widodo, & Setiadi, 2020). Cooperative learning refers to a variety of teaching methods where students work in small groups to help one another in learning teaching material (Kagan, 1990; Slavin, 2010). In a cooperative class, students are expected to be able to help each other, discuss and argue with each other to hone the knowledge they mastered at the time and close the gap in their understanding (Baker & Clark, 2010; Liew & Idris, 2017). The success of cooperative learning is determined by success as a group (Gillies, 2006; Tjosvold, Yu, & Hui, 2004; Zulkarnain, 2015). Therefore, the principle of cooperation needs to be emphasized in the process of cooperative learning. Not only must each group member set their duties and responsibilities, but also the need to instil mutual assistance.

One model of cooperative learning that can be applied to increase the student participation, cooperation and sense of responsibility of students is the cooperative learning model of the think pair and share (TPS) type (Hancock, 2014; Kothiyal, Majumdar, Murthy, & Iyer, 2013a). This method is one type of learning that is student-oriented learning (Ariana, 2013). This learning model presents a real problem for students in learning which will be solved through investigation and applied using a problem-solving approach (Kaddoura, 2013). The meaning of "*thinking*" in this method is the lecturer asking questions or issues related to lectures for students to think about it. Furthermore, "*pairing*" at this stage, the lecturer asks students to pair up to discuss. The results of intersubjective discussions in each pair of results are discussed with the whole class of pairs known as "*sharing*". This step is a simple learning approach that allows students to work alone and collaborate with others.

Think-Pair-Share is a simple method but very useful (Kwok & Lau, 2015). This method was first developed by Frank Lyman of the University of Maryland, where students are asked to sit in pairs. Then the lecturer asked one question/problem to them. Each student is asked to think individually about the answer to the question, then discuss the results of his thought with the pair next to him to get a consensus that can represent their answer. After that, the lecturer asks each pair to share and explain the results of the consensus and the answers they agreed on to the other students in the class. This cooperative learning method introduces the idea of wait or thinks the time to the cooperative learning interaction elements (Hamdan, 2017). Cooperative learning is currently one of the influential factors in improving student responses to questions. The benefits of the type of TPS cooperative learning methods are as follows.

1. Enables students to work alone and collaborate with others.
2. We are optimizing student participation.
3. Allow students to point their participation at others.

TPS type learning model is expected to facilitate students to hone and build student competency and creativity. Therefore, the authors intend to conduct classroom action research through the application of TPS methods in energy conversion learning.

2. Research Method

This research is a class action research adopting Kemmis & Taggart action steps. This research was conducted in class to find out the effects of the actions applied to a research subject in the class. This research is more broadly defined as research-oriented to the application of action to improve the quality or resolution of a group of subjects studied and observe the level of success or effect of its actions. The next process, observing until there is an adjustment to the conditions and situations in order to obtain better results.

This research is a TPS type class action research using the Kemmis & Taggart model as a reference cycle, which is in the form of a spiral from one cycle to the next (Kemmis, McTaggart, & Nixon, 2014). The spiral cycle of the stages of classroom action research can be seen in the following figure.

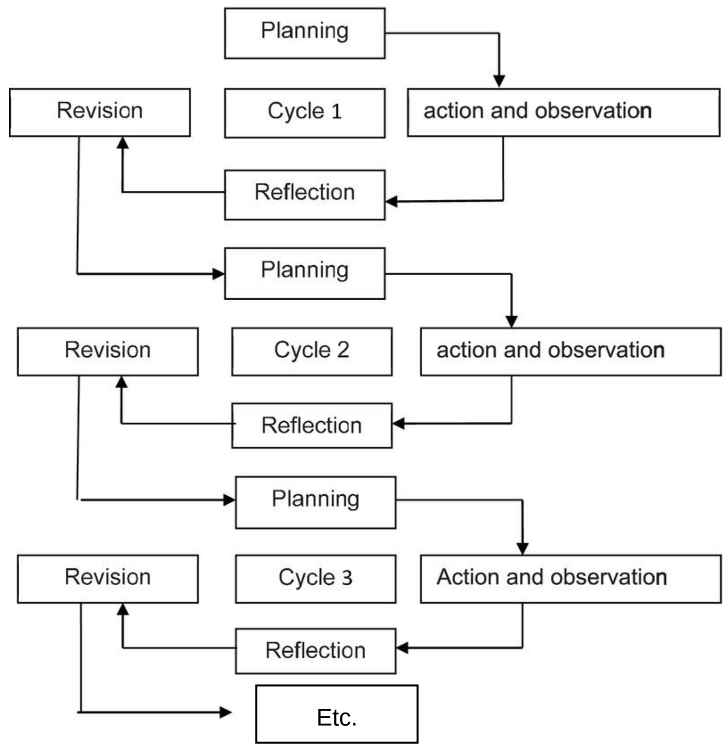


Figure 1. Class action research model according to Kemmis & Taggart

The design of the Kemmis & Taggart action research model consists of four stages, namely beginning with the action planning, implementing the action followed by observing the action, and reflecting. The action and observation stages in the Taggart Kemmis model are made into one stage because these two activities must be carried out simultaneously. This means that both of these activities must be carried out in a single unit; once the action has taken place, the observation must also be carried out.

This research was conducted at the Department of Mechanical Engineering Education, Universitas Negeri Yogyakarta. The subject used was a population of students who took the energy conversion course. The number of subjects that will be used to be carried out; the study considers three factors of limitations. These three limitations include limited time, limited analytical skills, and limited costs for completing research. The research subjects were two experts, namely lecturers in the field of learning theory and lecturers in the field of energy conversion. The application of the TPS model was carried out on 32 students who took energy conversion courses. From all research respondents, two of them are female and their age range is 17-20 years.

Data collection uses observations obtained by observing people and the TPS work process in class at the time of the study. This data collection technique has specific characteristics when compared with other techniques because observation can produce accurate data. Observations were made to analyze the student participation and cooperation of student learning. Documentation as secondary data was obtained from worksheet data, group lists, Learning Implementation Plans and assessment lists used to determine the members of each group in TPS type cooperative learning. Documentation is carried out to reinforce the research carried out in the form of writings, drawings or works from students.

Data analysis is the process of systematically searching and compiling data obtained from observations, interviews, field notes and other materials so that it can be easily understood and the findings can be shared with others. Data analysis conducted in this study was the analysis of observational data. Descriptive data analysis is used to describe the research data as it is and is not used to draw statistical conclusions. Data analysis from observations of student activities in this research activity is to reflect the results of observations in the form of student activity and collaboration analyzed with the following steps.

1. We are providing criteria for scoring each description or statement on each aspect of the observed activity.
2. Summarizing the scores for each of the observed aspects of student involvement then presented to make conclusions about student activity and collaboration.

3. The overall score for all aspects of activity is summed and then averaged.
4. Calculate the average score of observations of student involvement and cooperation.

$$Percentage = \frac{Number\ of\ Student\ activeness\ or\ collaboration\ scores}{Number\ of\ Students\ on\ a\ Class} x\ 100\% \quad (1)$$

The purpose of the percentage calculation is to determine the effect of how much increased activity and cooperation of student learning in the learning process in each cycle. To provide a category for increasing student activity and cooperation based on the interval scale that is converted into an ordinal scale based on the following table.

Table 1. Grading class intervals per cycle

Score	**Categorized**
81%-100%	Very good
61%-80%	Good
41%-60%	Good enough
21%-40%	Not bad
0%-20%	Very bad

3. Results and Discussion

3.1 The Implementation of the First Cycle

The implementation of the first cycle is carried out in one action. In this cycle, students are given material regarding water and solar cell energy conversion. The results of observations during the learning process are presented in the form of descriptive and quantitative data in the form of numbers, and then the quantitative data is presented in qualitative sentences. The results of the observation first cycle note that active students numbered four students and who showed an attitude of cooperation numbered eight students. If converted to a percentage, it becomes 12.5% or in the category of assessment interval is very bad for student activity and 25% with the not bad category for aspects of student cooperation. The category obtained in this cycle is still under the target of the achievement of aspects of student learning activities and cooperation, which is still very low under 60%. It happens because students are still not familiar with this type of TPS cooperative learning model, so many students are still confused about what to do and are passive in learning.

3.2 The Implementation of the Second Cycle

The second cycle is carried out in one action. In this cycle, students are given material regarding the conversion of wind energy, biomass, biogas, and biodiesel. Data observations during the second cycle learning process are presented the same as the first cycle, namely in the form of descriptive and quantitative data in the form of numbers, then the quantitative data are presented with qualitative sentences. The results of the observation of the second cycle found that the number of student involvement of students as many as 25 people and student learning cooperation as many as 17 people. If presented as a percentage, it becomes 78.1% or a good category for student activity and 53.1% or a good enough category for student collaboration. There was a significant increase compared to the first cycle. One supporting factor is that students and lecturers have adapted the TPS type of cooperative learning model.

3.3 The Implementation of the Third Cycle

The implementation of the action in the third cycle is carried out in one action. In this cycle, students are given material regarding the conversion of magneto hydrodynamic, geothermal and nuclear energy. Data observations during the learning process of the third cycle are presented in the form of descriptive and quantitative data in the form of numbers, and then the quantitative data is presented with a qualitative explanation. The results of the third cycle of observations found that the number of student participation was 31 students, and student learning cooperation was 32 students. If it is presented as a percentage, then it becomes 96.9% included in the very good category for student activity and 100% or the very good category for student collaboration.

Based on the three cycles, the next action is not taken because the data is already saturated. Improvement of each cycle shows that the TPS learning model can provide increased activity and collaboration between students. The type of TPS cooperative learning model applied in energy conversion learning through several stages including (1) random group formation through the value of daily test results; (2) discuss with group friends about the material provided; (3) make presentations and explain the subject matter that has been obtained; (4) conditioning the students' discussion process and giving instructions to cooperate; (5) question and answer process; and (6) reflecting. The percentage of each cycle in the following is illustrated.

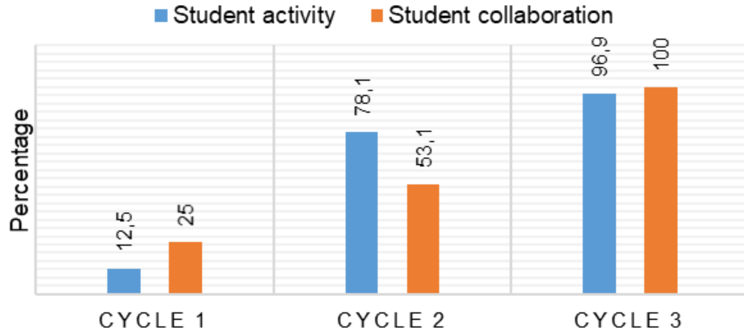
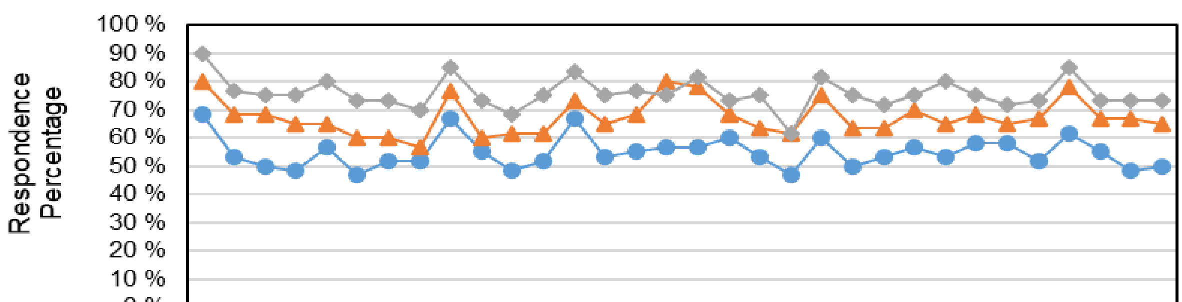


Figure 1. Differences and improvements in the assessment of student involvement and collaboration of cycles 1, 2 and 3

The obstacles that occur during the learning process and the application of actions are: (1) students still do not understand the syntax and assessment methods of the applied learning methods; (2) the attitude of students who are still individual in working on group assignments; (3) there are still few students who ask questions during the learning process (Bamiro, 2015). The strategies used to overcome these obstacles are: (1) explain again about the syntax and method of assessment of the methods applied by researchers at the beginning of learning and on the sidelines of learning; (2) optimize the process of discussion and presentation so that students want to work together with their groups so that students do not learn individually; (3) encourage students to ask questions, lecturers always remind that at the time of learning or the end of learning there is a reward for students and groups who are active in the learning process (Kaddoura, 2013; Kothiyal, Majumdar, Murthy, & Iyer, 2013b; Kothiyal et al., 2013a).



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Cycle I	68	53	50	48	56	46	51	51	66	55	48	51	66	53	55	56	56	60	53	46	60	50	53	56	53	58	58	51	61	55	48	50
Cycle II	80	68	68	65	65	60	60	56	76	60	61	61	73	65	68	80	78	68	63	61	75	63	63	70	65	68	65	66	78	66	66	65
Cycle III	90	76	75	75	80	73	73	70	85	73	68	75	83	75	76	75	81	73	75	61	81	75	71	75	80	75	71	73	85	73	73	73

Figure 3. Active and collaborative learning of each respondent in all cycles

Based on the results of the research conducted it can be concluded, that the use of the TPS type of cooperative learning model is indeed quite effective in increasing the activeness and cooperation of student learning in energy conversion learning. This learning model is straightforward and suitable for use by teachers who want to try new learning methods. TPS type cooperative learning models can be applied to both theory and practice learning. Students are required to be active and cooperate in groups in completing assignments given by the teacher. It happened because the type of TPS cooperative learning model prioritizes students to be active and cooperate in the learning process.

4. Conclusion

Based on the results of the research that has been carried out, it can be seen that the increase in the student involvement and cooperation of students after researching the results of observation in each cycle. The results of observations in the activity category have increased namely in the first cycle by 12.5% with the bad category, the second cycle by 78.1% with the good category and the third cycle by 96.9% with the excellent category. These observational data indicate an increase in activity in each cycle. Improved student learning collaboration after research can be obtained from observations in each cycle. The results of these observations are the first cycle of 25% with a bad category, the second cycle of 53.1% with a reasonably good category and the third cycle of 100% with a very good category. The observational data shows that the increase in student learning cooperation has increased in each cycle.

Researchers have several suggestions and recommendations for the successful application of this TPS method. Energy conversion lecturers can apply the TPS type of cooperative learning model to other similar material. This can be done by developing various forms of activities in the learning process so that the learning process becomes more exciting and varied so that students become more enthusiastic. Students are expected to be able to hone curiosity so that they become more active in finding material or data related to learning material so that it does not depend on lecturers.

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