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The improvement of students learning activities and learning outcomes in the program of industrial technical design through jigsaw instruction technique

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In an effort to meet the demands of the changing world, services provided by institutions of higher learning, are expected to be of quality, concrete and of promising outcomes. With this in focus, this research aimed: to establish the appropriate instruction technique that can improve students learning activities and at the same time enhance their learning outcomes; to prove whether the Jigsaw instruction technique could enhance students learning outcomes. The study revealed that: the jigsaw instruction technique could improve students learning activities and of course the learning outcomes. Besides, it was also revealed that the application of the jigsaw technique can contribute positively to the learning outcome of students.

Keywords: instruction, jigsaw technique, learning activities, and learning outcomes

One of the expected outcomes of university education is self reliance; learners are expected to be independent throughout the learning process. It is time for them to become self-directed learners and not dependants (on lecturers). At Gorontalo State University, each student must become a lifelong learner (able to learn on their own) both on and off campus. Because of this, students need to be physically and emotionally engaged if they are to understand and handle the educational challenges faced.

In the course of this study, it was noticed that only 30-40% of the students are active during lectures, and the rest tend to be silent, and some times fail to pay attention during lecture time. This happens even in the presence of those lecturers who endeavour to motivate and offer opportunity to students to actively participate in class. This is one of the biggest problems faced by lecturers in the technical design program. According to the observation of 14 students, it was established that about 2 to 3 students were active during the lecture period.

This leads to poor quality of learning outcomes. Based on the report by the head of department of the industrial design, the average score of students' grade is 2.70. This was further confirmed by the preliminary test performed on the students offering the course of jigsaw instruction who on average scored 2.50.

The poor performance is influenced by various factors, which are both internal and external (Biggs & Tefler, 1987: 141-163; Winkel, 1991: 200-210). The internal factors affecting the learning activities include: attitude, motivation, concentration, intelligence, emotional intelligence, talent and interest, whereas the external factors are: learning materials, the source for learning, learning environment, and students-lecturer relationship at times also greatly influence students' learning. By defining the factors that influence learning outcomes; helps in developing appropriate techniques for successful learning.

In relation to the internal and external factors, the method used can also influence students learning outcomes. Basically, the commonly used method is question-answer method, where most of the

questions and answers are from the lecturers themselves. This results in a one-way learning interaction (from lecturer to the student or the student is there to listen the lecturer's explanation).

The Jigsaw Technique: is one of the cooperative learning technique in which students work in groups, learn with and or from peers. By this technique, students are a source for learning and also seekers of information. Thus, students inevitably perform a variety of learning activities. The game of the rule here is that, if the learning activities are not performed by the students, the learning outputs are greatly affected. This method was chosen based on the assumption that: 1. learning through group activities can help to improved students competencies; 2 to learn by help friends and or fellow students, can lead to free inquiry, expressing of opinions, and accepting to be criticized by or friends opinion; 3. learners own friends explanations since the language used is easily understood, compared to the lecturer's explanation, 4. this technique is not widely used; and 5. this technique can improve students' learning outcomes.

Research problem

The problem of this study was formulated as: 1. Does the use of Jigsaw instruction techniques enhance students' competencies? 2. Is the use of Jigsaw technique of influence to students learning activities and or learning outcomes? This research was conducted with the purpose of: 1. to improve undergraduate students learning activities through the course of jigsaw instruction, 2. to improving students learning outcomes through the course of jigsaw instruction.

Learning is an interaction between the individual and the surrounding situations directed by learning objectives. Active learning is not only characterized by the activity of students learning physically, but also mental activity. According Pannen and Sekarwinahyu (1994:6) mental activity is extremely important and a major component of active learning than physical activity. Dimiyati and Mudjiono (2009:114) refer to active as a leading learning approach that leads to optimized intellectual-emotional engagement during the learning process, with the involvement of the physical aspect where necessary. Such an opinion is different from that of Silberman (1996:1 - 9) who is of the opinion that active learning does not only involve the physical aspect but also the mental one.

Based on the above opinions, it can be concluded that the learning activities involve cognitive, affective, and psychomotor of the learners. Raka Joni (1992:1) explains that through learning activities, students are expected to be better able to recognize and develop their learning capacity and potential, trained to be creative, systematic thinkers, critical, responsive, and able to solve the problems. Similarly, Pannen and Sekarwinahyu (1994:6-6) say that learning activity is assumed to be an activity that can form the student as a whole person who has the self ability to lifelong learning. Learning outcomes or achievements can be interpreted as achieved results or real results obtained by a person after participating in a learning activity. Gagne (1985) classified learning outcomes into five types, which are (1) intellectual skills, (2) cognitive strategies, (3) verbal information, (4) psychomotor, and (5) attitude. Besides Gagne theory, adult learning outcomes theory that is still used in the education world of Indonesia is Bloom et al theory. Bloom classified learning outcomes into three domains, which are: (a) cognitive, (b) affective, (c) and psychomotor domains. A description of the forms of learning outcomes shows that student learning outcomes cover all aspects of the students' personality. Thus, learning achievement is at times referred to as learning outcome. In education, the determinant of a student's learning outcome is a lecturer who should carefully and accurately involve students throughout the learning process. One of the techniques used is that developed by Elliot Aronson (Jigsaw technique). This technique is not only designed to increase student responsibility, but also required for positive interdependence (mutual help) with a group of friends. Students work with each other in a mutual cooperation atmosphere and a lot of opportunities to process the information and to strengthen the communication skills. (Lie, 2004:69). Learning materials and text are given to students and they are responsible for mastering the material and able to teach other group members (Arends, 1997; Slavin, 1995; Silberman, 1996). The members of the different groups who are representatives of the groups meet to discuss the same topic (discussion among experts), help each other to learn their topics assigned. Furthermore, these students return to their respective groups (the origin group) to explain to a group of friends who have learned the material. Students participate in learning determined by lecturer methods in the learning process. Various activities performed by students in learning will help them to better understand the material they have learned. A clear understanding and mastery of the material impact on the acquisition/ learning outputs expected.

Method

Participants

The method used in this research was Classroom Action Research (CAR), it entailed: planning, action, monitoring and evaluation, analysis and reflection. Implementation of actions of the Jigsaw learning technique was done within 3 (three) cycles. All learning steps were the same for each cycle, but differed in terms of material.

This research was conducted on 14 students in the semester (VII) of the fabric design program at Gorontalo State University. Students learning activities data was obtained through an observation sheet. Observations were conducted during the learning process, and were based on the following points as indicators: 1. the teacher-student interaction, 2. the peer answering the friends or the teacher, 3. the students exchanging opinion, 4. response to the teacher or friends' opinion. Each indicator was counted based on the frequency of the student engagement. Then a score was given. The scores were as

follow: If the 4 indicators appeared = 100 score, if 3 indicators appeared = 75 score, if two indicators appeared = 50 scores, if one indicator appeared = 25 score, if none of the indicators appeared = 0 score. Student outputs data was obtained through achievement test. The data on the learning process was gained through an observation sheet that contains an overview of the indicators of the jigsaw learning technique. Data analysis was carried out using percentages to calculate the improvement in student learning activities in each cycle, students learning output was analyzed by calculating the average of students' results in each cycle, and data on the learning process were analyzed by using qualitative analysis.

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Results and discussion

Research Results: This research was conducted in three (3) cycles, each cycle consisted of 3 (three) meetings. Cycle I discussed the 3 (three) subjects: Factors that affect learning, Principles of Learning and Motivation. Cycle II discussed some major topics: Learning, Contextual Teaching and Learning Approach and Curriculum Development. Cycle III discussed some major topics: Evaluation of Learning Basic Concepts, Teaching and Learning Evaluation Results and Learning Issues. Implementation of the action in each cycle is described as below:

Cycle I:

The results in the first cycle were described as follows: Analysis of Learning Activities: Learning activities that are created by lecturers are assumed to affect the learning activities of students. Learning activities measured aspects include: (1) a class presentation, which include; information, learning objectives, students motivation, linking learning to prior knowledge, (2) the formation of groups, (3) determination of the representative group, (4) expert group discussions, (5) material presentation by the expert, (6) evaluation, (7) then award, and (8) inference. The observations of the learning activities are described as follows:

At the meeting, the class presentation step consisted of 4 aspects, namely: linking learning to the prior knowledge aspect, here teachers focus on learning strategies, and explanation; formation of expert groups and determining the representative group step (determined by the lecturer). The lecturer seeks a heterogeneous group in terms of student ability; the representatives of the groups are students with high ability; expert group discussion: students appointed to the expert group are students of ability. At this step, students' explanation appeared to be less clear, as one of the experience of peers teaching themselves; and later on, group award

and inference step also conducted by students. At this stage, the teachers were focused on evaluation of learning output or outcomes than paying attention to the achievement of the individual student.

At the meeting, class presentation consisted of 4 aspects. However, two aspects were not used, namely: the motivation of students, and linking learning to prior knowledge. Because of this, lecturers were more focused on explaining learning strategies than activities. The group formation process and representatives were chosen democratically. These two activities were implemented by students after receiving an explanation about the terms and condition from the lecturer and the expert. During the expert group discussion step, there were also passive students; they only listened to the explanation of friends without comments. During material presentation by the expert group, it turned out that the explanation was less obvious. It was concluded by the lecturer's evaluation.

Activities for the meeting, Analysis of Student Learning Activities: Students learning activities were measured based on the aspects (1) ask, (2) answer, (3) opinion, (4) response. The scoring was determined as follow: if 4 indicators appear, 100 scores; if 3 indicators appear, 75 scores; if 2 indicators appear, 50 score, if one indicator appears, 25 score; and if no indicator, 0 score.

Before this jigsaw technique was implemented, preliminary observations on student learning activities were done. The observations were held on the 3rd meeting some of the lectures involved were left to use the lecture method of question and answer technique. Based on the observation results, students' learning activities were at average mark of 25%. But with the implementation of the of the new technique on four lectures (conducted using a jigsaw technique). The students' average mark rose to 46.39%. The observations also revealed an increase in students' learning activities at each meeting.

Analysis of Student Learning Outcomes: Student learning outcomes were measured at the end of the meeting, after evaluation of the score. To determine the changes, an assessment guideline applicable at Gorontalo State University was used, which is as: 85-100% = A, 70-84% = B, 55-69% = C, 50-54% = D and less than 54% = E. It was found that the learning outcomes of students increased at each meeting. At the 2nd meeting the learning outcomes had highly improved.

Students' feedback Analysis: Feedback was obtained through direct interviews with students. This was based on the belief that the interview technique would obtain more accurate data, and also with a total number of only (14 students), interview was more appropriate. Strength of this technique: (a) students were very pleased to be involved directly (80%), (b) Some of the students expressed desire for lecturers to continue applying peer to peer teaching approach (20%), (c) students tried their level best to master the material, because of the direct evaluation, (d) students also expressed that an additional of 100 minutes was less for discussion at the same time mastering the material.

Reflection: Based on the quantitative and qualitative data analysis there are areas that need improvement, they are: (a) the learning activities need to be improved-this can be done through expert group discussion and by explanation on what to do, (b) timing should be proportional to each step in the learning process, (c) the students' learning activities need motivation from lecturers, (d) lecturers should clarify the material to be covered by the expert groups through clear explanation.

Cycle II

The results in the cycle II were as follow: Analysis of Learning Activities: Observed aspects in cycle II during the learning process were basically those aspects were not clearly handled during the first cycle, i.e.; learning activities (in relation to prior knowledge), expert group discussion, and teaching materials from the chosen group of experts (who are student peers). During the second phase, the entire learning process was conducted based on the prior design and it was smoothly managed. According to the researcher's analysis this was because of appropriate division of time for each lesson (or learning process), and there was emphasis on clarity of the material as well as on time expert group motivation.

Analysis of Student Learning Activities: The observed aspects were basically those aspects already conducted in cycle I. The results at this second cycle of learning (meeting 1, 2, and 3), revealed an average score of 55.91%. However, during meeting 2 of this cycle II, the score appeared lower than that obtained at meeting 1 and 3. According to the researcher's analysis, it was due to the material used in the discussion which required an in-depth analysis by the students; the materials were on Contextual Teaching and Learning (CTL). There was no improvement as compared to the first cycle and second cycle where scores of 46.39% and 55.91% were respectively obtained.

Cycle III

The results of the third cycle: Analysis of Learning Activities: The results showed that the entire lesson was smoothly carried out. Both the lecturers and students had got familiar with the use of the Jigsaw instruction technique.

Analysis of Student Learning Activities: The students' learning activities improved at each meeting with an averaged score of: 76.62%, this is of course larger than that obtained during the second cycle which is 55.91%. During the third cycle, it was observed that the jigsaw technique led to student high motivation. Based on the interviews conducted, the students expressed a very high interest and were motivated to learn, because they are free to comment, ask or respond to discussions between peers and use their own language.

Analysis of Student Learning Outcomes: Student results at the third cycle after testing revealed an average grade 3.33 (B). This implied that, the student had achieved a great improvement in their learning at every meeting of the third cycle. The table below presents some of the students' scores taken from the third cycle:

Summary of Student Learning Activity and output Average Score Table

Cycle	learning activities	Learning output
Preliminary observations	25%	2,50
Cycle I	46,39%	2,41
Cycle II	55,91%	3,33
Cycle III	72,62%	3,33

Based on the table above, it can be concluded that the use of jigsaw technique in learning can improve learning activities and outcome of the students.

Conclusion

The results of this research indicate that the use of jigsaw techniques in learning can improve students learning activities. The students of

industrial design program attained an improvement in performance after using this technique. In addition Jigsaw Technique improved student learning outcomes.

The jigsaw technique can lead to a condition that stimulates students to perform a variety of learning activities. Besides, through the jigsaw technique, students learn from their peers. Thus, they are free to ask questions, answer questions from friends, express their opinion or respond to the opinions of friends. This condition can help students understand the materials that have been studied. In addition, the activity requires lecturers to check the results through evaluation at each meeting. It can be difficult if it is a large number of students.

This research conducted on the use of jigsaw technique in the learning process can be detailed described as: (a) Students are more active in the learning process, this impacts on students learning outcome, (b) Students are more motivated to learn because at each meeting there is individual evaluation, (c) There is competition among the students, (d) The Lecturer acts more as a mentor, motivator, facilitator, and manager of the learning process. Based on the research findings:

1. Application of jigsaw technique can improve the quality of students learning activities. This was indicated by improved student learning activities in the industrial technical design program where there was an increase of 47.62%, different from the initial score of 25% to 72.62%.
2. Application of the jigsaw technique in teaching can improve student learning outcomes. This was demonstrated by an increase in students learning outcomes during a pre test done in the course of learning and jigsaw instruction technique there was an improvement in the score from 2.50 (C) to 3.33 (B) on average.

Recommendation of the study

According to the research findings the recommendations are:

- The jigsaw technique should be applied in learning at every level of education, since this technique can stimulate students to think effectively through discussion among each other, so that the material can be understood more meaningfully. In addition, the application of this technique can help students in developing social skills,
- It is time for students to learn with learning techniques demanding independence in learning, where students learn independently without much reliance on the lecturer, and
- For the researcher he should be able to do this research as a class action under different conditions, both in terms of number of students and characteristics of matter.

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