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The Effect of the Jigsaw Learning Model on Student Learning Outcomes at the Agricultural Vocational High School

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ABSTRACT
The jigsaw learning model is an innovative learning model that can increase student engagement. This learning model can be applied to various fields of learning in vocational high schools, including agricultural vocational high schools. However, information regarding the effect of this learning model on agricultural vocational high schools is still lacking. This study aims to analyze the effect of applying the jigsaw learning model to student learning outcomes in agricultural vocational high schools. The jigsaw learning model will be applied to a class. Data on student learning outcomes are collected using instruments that have been compiled and validated by experts. Data on learning outcomes before applying the learning model (pre-test) were compared with data on learning outcomes after applying the learning model (post-test) and analyzed using paired sample t-test. Improved learning outcomes were analyzed by N-Gain. In addition, student completeness will also be analyzed. The results of this study indicated that the instrument for collecting data on learning outcomes was valid. After applying the model, the average post-test of students was 94.7. The analysis revealed that there was a significant difference between the pre-test and post-test scores ($p<0.05$). N Gain analysis showed that the increase in student learning outcomes was 75.46%. After applying the jigsaw learning model, student learning completeness was 100%. The results of this study indicate that applying the jigsaw learning model in Agricultural Vocational Schools can significantly increase the effectiveness of the student learning process.

Keywords: *Classroom Action Research, Cooperative Learning, Completeness, Learning Strategy.*

1. INTRODUCTION

Effective learning is essential for students. In traditional learning in the classroom, the lecture method is widely used by teachers. The teacher has more role in this method so that passive learning occurs [1], [2]. Several previous studies have compared the effectiveness of learning with traditional methods with other learning methods and found that the effectiveness of learning with traditional methods is lower when compared to other methods. [3]–[5]. To increase the effectiveness of the learning process, teachers began to apply cooperative learning strategies.

Cooperative learning is an instructional strategy that endeavors to structure classroom activities in a manner that facilitates both academic and social learning opportunities [6], [7]. Cooperative learning is an instructional approach wherein students are organized into small groups to facilitate mutual assistance in understanding the subject matter [8]. The five fundamental elements of cooperative learning encompass positive cooperation, interaction propensity, individual accountability, the cultivation of interpersonal and social aptitudes, and the quality of group achievement [9]. Several studies have reported that the use of cooperative learning strategies can increase student motivation and learning outcomes [9], [10].

One form of cooperative learning is the jigsaw learning model. The utilization of the Jigsaw method has been found to be advantageous for students' learning outcomes [11]. Cooperative learning is a pedagogical approach that facilitates the cultivation of teamwork skills among students, which is a crucial competency in the context of Socio-Environmental Synthesis [12]. The utilization of the Jigsaw method yields various advantages, particularly in enhancing the dynamics of teams and classes. This approach facilitates the establishment of trust among participants, fosters an

environment conducive to open and honest communication, encourages respectful expression of differing viewpoints, and provides a safe platform for individuals to take emotional risks [13]. Facilitates the formation of cohorts by fostering a deeper level of acquaintance among students within a single class, thereby potentially leading to increased engagement in extracurricular activities both within the department and across the campus [14], [15].

The jigsaw learning model consists of multiple sequential steps [14], [16], [17]. Initially, the process involves categorizing students into distinct groups based on the number of sub-topics of information that will be covered. The designated group is commonly referred to as the "home group." Optimal results are achieved when each group is comprised of an equal number of students. 2. Allocate a distinct sub-topic to each individual within the Home Group, ensuring that each group member assumes responsibility for teaching a specific sub-topic. The assigned student will assume the responsibility of imparting their acquired knowledge to the remaining members of the group. Each student is expected to read their respective information. Following individual study, students convene with their peers who share the same sub-topic within the classroom setting. The group is formally referred to as the Expert Group. Within each Expert Group, students collaborate in order to analyze and synthesize information. Subsequently, a mechanism was established to facilitate the dissemination of said information among their respective home groups[18].

Several researchers have tested the effectiveness of jigsaw learning in various subjects, such as biology [16], english [18], nursing [12], and engineering [19]. The results of these studies indicate that the jigsaw learning model can significantly increase student motivation and learning outcomes. However, research on the application of the jigsaw to agricultural lessons is still lacking. In addition, many studies on the jigsaw focus on high schools. Research on the application of the jigsaw learning model is still lacking in vocational high schools.

This study aims to analyze the effect of applying the jigsaw learning model to student learning outcomes in agricultural vocational high schools. The primary hypothesis is derived from the literature, which highlights the positive effects of jigsaw learning on learning outcomes. Primary hypothesis from this research is students who experience the jigsaw learning method will achieve higher learning outcomes. The results of this study can contribute to improving the literature with empirical investigations on the effect of jigsaw learning at the agricultural vocational high school.

2. METHODS

2.1. Participant

Participants in this study were all students of class X who took the subject of Agricultural Equipment and Machinery at an Agricultural Vocational High School. The number of participants was 18 people, consisting of 11 men (61%) and 7 women (39%).

2.2. Instrument

The instrument for collecting data on learning outcomes is an instrument that was developed by the researcher based on the material being taught. This instrument consists of 20 multiple choice questions with 5 answer choices. This instrument is used when the pre-test and post-test are given to students. This instrument was validated by 3 experts in the field of Agricultural Equipment and Machinery and the results were declared valid [12]. In addition, this instrument was tested for reliability using Cronbach's Alpha and the results showed that the resulting value was r = 0.82. Testing the reliability of the instrument was carried out before the research was carried out and involved 10 students other than students who were participants in this study [13].

2.3. Procedure

Before starting the research, a permit process was carried out to obtain a formal approval form from the school authorities and to provide information about students' involvement in this research. In addition, students involved in this study were informed about the purpose of the research, that their involvement was voluntary and that they could withdraw as research participants. Then, they are informed that the personal data collected will be treated confidentially, and deleted after the study is completed [20].

The pre-test was given at the beginning of the study to determine students' initial abilities regarding the material being taught. Then, the application of the jigsaw learning model is applied [12][13][14]. The application of the jigsaw begins by dividing the participants into several groups according to the number of sub-materials chosen by the researcher. All groups was be asked to study Agricultural Equipment and Machinery materials. After that, each group member was given a mark and asked to study the sub-material that had been chosen by the researcher. The selected sub-materials were divided into 4, namely 1) identification of agricultural tools and machinery, 2) parts of hand tractors, 3) parts of tillage tools, and 4) components of motor fuel.

The first session of learning begins after the groups were formed and they were told how they will study, what material they would learn, and what sub-materials they would teach their group. This group was called a

"Home Group". Researchers provided examples and demonstrations so that students better understand the jigsaw learning process being carried out [12]. In the second session, students were directed to form an "Expert Group". This group contains members who had the same sub-topic. Each member of this group was directed to study the selected sub-topic and discussed the sub-topic so that they mastered the sub-topic well [13]. In the third session, the researcher asked students to return to their respective home groups to explain the material they had learned to other home group members. The researcher guided the groups when they explained the material to the home group members [21]. In the last session, they were given a post-test on all the sub topics they had studied [14]. The jigsaw learning process in this study is shown in Figure 1.

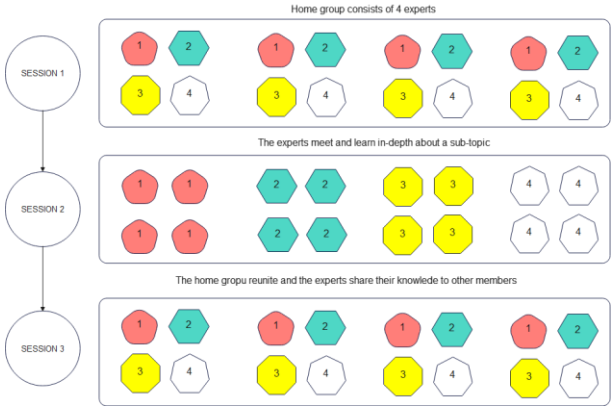

Figure 1. The pattern of the jigsaw learning model applied to this study

2.4. Statistical analysis

The data collected was analyzed with descriptive statistics in graphical form. In addition, data on learning outcomes before applying the learning model (pre-test) were compared with data on learning outcomes after applying the learning model (post-test) and analyzed using paired sample t-tests. If the p value <0.05, it can be concluded that there is a significant difference between the results of the pre-test and the results of the post-test [22], [23]. Improved learning outcomes were analyzed by N-Gain [24]. In addition, student completeness will also be analyzed. Students who have learning outcomes > 75 can be said to be students who have completed and passed [25].

3. RESULTS

Based on the results of the analysis, the average student learning outcomes before applying the jigsaw learning model was 46.1, while the learning outcomes after implementing this model were 94.7 (Figure 2). Paired sample t-test shows that there is a significant difference between learning outcomes before and after the application of the jigsaw learning model (p <0.05). The results of the N-Gain analysis show that there is an increase in learning outcomes in the post-test by 75.46% when compared to learning outcomes in the pre-test. Based on the results of the learning completeness analysis, after the application of the jigsaw learning model, student learning completeness was 100%. In general, the results of this study indicate that the application of the jigsaw learning model can improve student learning outcomes at Agricultural Vocational High School.

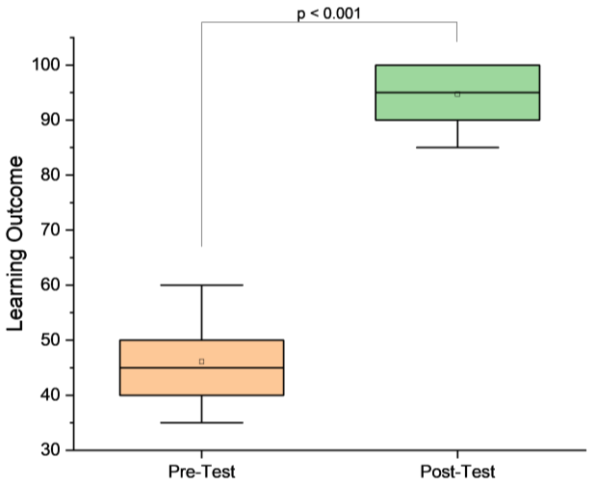

Figure 2. Learning outcomes before (Pre-Test) and after (Post-Test) the application of the jigsaw learning model in the subject of Agricultural Machinery and Tools at the Agricultural Vocational High School

4. DISCUSSIONS

The present study was designed to determine the effect of applying the jigsaw learning model to student learning outcomes in agricultural vocational high schools. The results of this study show that the application of the jigsaw learning model has a significant effect on improving student learning outcomes. The implementation of the jigsaw technique facilitates the practice of active listening, active participation, and the fostering of empathy by assigning distinct responsibilities to each group member in the academic task. In order to attain a collective goal, it is crucial for individuals within a group to engage in efficient collaboration, functioning as a unified team, wherein each member depends on the contributions of their fellow peers. [16], [26]. This allows for a significant increase in learning outcomes. The results of this study are also in line with previous studies [18], [27]

One interesting finding is the completeness of student learning which reaches 100%. These results indicate a high level of effectiveness of the jigsaw learning model as a cooperative strategy. One possible explanation for this phenomenon may be linked to the implementation of the jigsaw strategy. This instructional approach empowers students to take ownership of their learning,

bolster their capacity for retaining information, participate in peer tutoring, develop proficient communication skills, and enhance their aptitude for retrieving and applying conceptual knowledge. [12], [16]. This result is in line with previous research which states that the jigsaw can improve critical thinking skills [28] and literacy skills of students [29].

An increase in learning outcomes of 75.46% is a significant increase and is very beneficial for student development. The increase in learning outcomes, especially in the lesson of agricultural tools and machinery, may be due to the jigsaw technique has been found to be an effective instructional approach for facilitating the learning of both theoretical and practical aspects of science. The utilization of the jigsaw method as a collaborative learning approach has been observed to yield beneficial effects on multiple facets of students' educational journey. The observed effects of this phenomenon include an increase in students' motivation, improved learning outcomes, enhanced reasoning abilities, heightened critical thinking skills, elevated academic achievements, and greater overall engagement in the learning process [11], [30]. The incorporation of cooperative learning strategies yielded significant advancements in students' interpersonal relationships, encompassing heightened peer affiliations, diminished group disputes, and elevated levels of self-worth. [17], [31].

This research is limited to quantitative variables, namely focusing on student learning outcomes. The incorporation of qualitative methodologies would have contributed to a more comprehensive comprehension of jigsaw learning model. For example, conducting interviews with students would have facilitated a deeper comprehension of the specific aspects of the jigsaw learning model that effectively stimulated positive outcomes [14]. This approach could have potentially advanced our knowledge and provided a more comprehensive understanding of the advantages associated with the implementation of the jigsaw technique. Hence, the inclusion of qualitative components in the research design will enhance future investigations.

This research contributes to the development of an understanding of the jigsaw, especially in the development of students in agricultural vocational high schools. The jigsaw learning model in agriculture lessons can also improve student learning outcomes. As in previous research which has found that the application of the jigsaw can increase the effectiveness of student learning in various subjects [16], [18], [31]. The findings reported here suggest that it is necessary to increase the use of the jigsaw learning model by teachers, especially for various lessons that teach concepts and theories.

5. CONCLUSIONS

The analysis revealed that there was a significant difference between the pre-test and post-test scores ($p<0.05$). N Gain analysis showed that the increase in student learning outcomes was 75.46%. After applying the jigsaw learning model, student learning completeness in the second cycle was 100%. The results of this study indicate that applying the jigsaw learning model in Agricultural Vocational Schools can significantly increase the effectiveness of the student learning process.

AUTHORS' CONTRIBUTIONS

Jamaluddin conducted research, compiled manuscripts, and carried out the final revision. Reski Febyanti Rauf assisted in collecting data and compiling manuscripts. Andi Alamsyah Rivai did the analysis.

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