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Jigsaw Learning Model Improves Student Learning Outcomes In Mechanical Engineering Basic Knowledge

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ABSTRAK

Masih banyak siswa yang mendapatkan nilai dibawah rata-rata. Hal ini disebabkan karena guru masih menggunakan model pembelajaran konvensional yang membuat siswa kurang termotivasi dalam belajar. Penelitian ini bertujuan untuk menganalisis pengaruh model pembelajaran kooperatif tipe jigsaw terhadap hasil belajar siswa kelas X pada mata pelajaran pengetahuan dasar teknik mesin. Penelitian ini menggunakan posttest only group design. Populasi penelitian ini adalah siswa kelas X Teknik Pengelasan. Pengambilan sampel dilakukan dengan menggunakan teknik random sampling. Sampel pertama (kelas A) yang berjumlah 30 siswa merupakan kelas eksperimen. Sampel kedua (kelas B) yang berjumlah 30 siswa merupakan kelas kontrol. Metode yang digunakan dalam pengumpulan data adalah metode dokumentasi dan metode tes. Analisis data kedua kelompok menggunakan analisis statistik deskriptif dan analisis statistik inferensial melalui uji t sampel independen. Hasil penelitian menunjukkan terdapat perbedaan hasil belajar pengetahuan dasar teknik mesin siswa pada kelas eksperimen yang diajar dengan model pembelajaran jigsaw dengan menggunakan model pembelajaran konvensional. Disimpulkan bahwa model pembelajaran jigsaw dapat meningkatkan hasil belajar siswa pada mata pelajaran teknik mesin.

ABSTRACT

There are still many students who get scores below the average. Teachers still use conventional learning models that make students less motivated to learn. This study aims to analyze the effect of the jigsaw cooperative learning model on the learning outcomes of class X students in the subject of basic knowledge of mechanical engineering. This study used a posttest-only group design. The population of this research is class X Welding Engineering students. Sampling was done by using a random sampling technique. The first sample (class A), totaling 30 students, is an experimental class. The second sample (class B), totaling 30 students, is the control class. The methods used in data collection are the documentation and test methods. Data analysis of the two groups used descriptive statistical analysis and inferential statistical analysis through independent sample t-tests. The results showed differences in the learning outcomes of students' basic knowledge of mechanical engineering in the experimental class taught using the jigsaw learning model using conventional learning models. It was concluded that the jigsaw learning model could improve student learning outcomes in mechanical engineering subjects.

1. INTRODUCTION

Education is very important in developing the human personality both spiritually and physically (Bożek et al., 2020; Ferrer et al., 2022; Narayanan et al., 2023). The rapid development of education is strongly supported by the Ministry of Education and Culture which always provides improvements to the education system, one of which is the education system at the Vocational High School level with the aim of achieving quality graduate results (Anggraini et al., 2018; Coman et al., 2020; Hidayat & Muladi, 2016; Utami, 2017). St Aloisius Ruteng is one of the formal educational institutions that prepares students to become skilled workers in certain fields, in the process of teaching and learning activities at St Aloisius Ruteng Vocational School, the teacher is still dominant using conventional learning models for various subjects, one of which is knowledge subjects basic mechanical engineering (Keiler, 2018).

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The subject of basic knowledge of mechanical engineering is one of the branches of vocational subjects that discusses the theory of basic mechanical science that is learned before practicing, the material of basic knowledge of mechanical engineering includes many things that have to do with mechanics (Maulana et al., 2022). The conventional model is not suitable for science subjects basic mechanical engineering, because seen from the student's response when learning shows a bad attitude, there are still many students who are sleepy during the learning process, and students also don't pay attention when the teacher teaches, this has a huge impact on student learning outcomes (Cicekci & Sadik, 2019; Hasriani G, 2022).

Based on the results of the odd semester exam of students from teachers of basic knowledge of mechanical engineering shows that the average value of students in class X WE (Welding Engineering), who achieves the Minimum Completeness Criteria value is only 30% while students who do not achieve the Criteria score Minimum completeness as much as 70%. To overcome this problem, it is necessary to make an effort so that students' understanding of the basic knowledge of mechanical engineering becomes better, in the sense of changing the way teachers teach from those who still use conventional learning models to using innovative learning models (Nouri, 2016; Ordu, 2021).

Many learning models can be applied by paying attention to elements such as demanding student activity, and fun during the learning process (Amerstorfer & Freiin von Münster-Kistner, 2021; Amin et al., 2020; Annisa & Sutapa, 2019; Philp & Duchesne, 2016; Puspitarini & Hanif, 2019). One of the innovative learning models is the jigsaw learning model. The jigsaw learning model is learning that is carried out by encouraging students to express opinions and manage information so that students are directly able to improve communication skills from the material that has been studied (Darling-Hammond et al., 2020; Effendi-Hasibuan et al., 2020; Heriwan & Taufina, 2020; Saputra et al., 2019; Subiyantari & Muslim, 2019) . The jigsaw learning model is a cooperative learning model in which learning through the use of small groups of students who work together in maximizing learning conditions to achieve learning objectives and get the maximum learning experience, both individual experience and group experience (Gunawan et al., 2021; Hasibuan et al., 2020; Salleh et al., 2015; Utomo et al., 2020).

Previous research found that Jigsaw is one of the cooperative learning models that can be applied in heterogeneous classes (Dewanti, 2020; Maison et al., 2021; Subiyantari et al., 2019; Wati & Anggraini, 2019). In this type of jigsaw cooperative learning, each student becomes a member of two groups, namely the home group and the expert group, the original group members consist of 3-5 people (Hoerunnisa & Suherdi, 2017; Putra et al., 2018). Student in the Jigsaw learning model, students have many opportunities to express opinions and process the information obtained (Maielfi & Wahyuni, 2020; Msangya et al., 2016; Nurfitriyanti, 2017; Yemi et al., 2018). Group members are responsible for the success of the group and for the completeness of the material being studied, so that in students a positive attitude of dependence is formed which makes group work optimal (Letina, 2020; Maielfi & Wahyuni, 2020; Maison et al., 2021; Siddig & AlKhoudary, 2018). Based on the problems found by the researchers during the initial observations described above, and one of them can be overcome by selecting the appropriate learning model. There needs to be a study on the Effect of the Jigsaw Learning Model on Student Learning Outcomes in the Subject of Basic Knowledge of Mechanical Engineering. This study aimed to analyze the influence of the Jigsaw Learning Model on Student Learning Outcomes in the Subject of Basic Knowledge of Mechanical Engineering.

2. METHOD

This study used a posttest-only control design. The population in this study were students of class X Welding Techniques and the samples of this study were students of class X A and X B, there are two variables in this study, namely the independent variable and the dependent variable, the independent variable is the Jigsaw cooperative learning model and the dependent variable is the Jigsaw cooperative learning model student learning outcomes. The research process was carried out for seven meetings, six meetings for treatment and one meeting for data collection. This research uses classroom action research. The purpose of this study was to determine the difference in learning outcomes of students who follow the jigsaw type cooperative learning model with students who follow the conventional learning model in the subject of basic knowledge of mechanical engineering in the 2022/2023 school year.

Student learning outcomes in the two classes were measured using an objective test in the form of multiple choice, the number of multiple-choice questions was 20 items. Before the test is applied to the experimental group and the control group, to get a good test device, it is necessary to analyze the characteristics, the purpose of the characteristic analysis is to determine the level of question validity, difficulty level, discriminating power, and the level of reliability of the questions (Morgado et al., 2017; Peters-burton & Stehle, 2019). The methods used in data collection are the documentation method and

the test method. The instrument used in this research is a written test in the form of objective questions (multiple choice). Analysis of instrument testing includes item validity test, item difficulty level test, item discriminatory test, and item reliability test. The data analysis technique in this study is the analysis prerequisite test and statistical hypothesis testing.

3. RESULTS AND DISCUSSION

Results

Based on the descriptions and calculations, the results of learning basic knowledge of mechanical engineering in the experimental class are taught using the jigsaw type cooperative learning method, the lowest score is 40 and the highest score is 100. Student learning outcomes in the experimental group are presented in the form of a frequency distribution table. In the frequency distribution table, it can be seen that the most scores obtained by students in the experimental group in the 70-79 interval is 43,33%, students who get values above the average are 66.65%, namely from the 70-79 interval, 80-89, 90-100, while students who scored below the average were 33.32% from the intervals 40-49, 50-59, 60-69.

Table 1. The frequency table of learning outcomes in experiment class

Score	Median	Absolute Frequency	Precentage %
40-49	45,5	1	3.33%
60-69	54,5	1	3.33%
60-69	64,5	8	26,66%
70-79	74,5	13	43,33%
80-89	84,5	5	16,66 %
90-100	94,5	2	6,66%

Calculations to find the central tendency of the score for learning the basic knowledge of mechanical engineering use the help of the SPSS 22 for windows program. From the results of these calculations, the average value (Mean) is 70.50, the median is 70.00, the mode is 70, the standard deviation is 12.202, the variance is 148.879, the range is 60, the minimum is 40 and the maximum is 100. The frequency distribution of experimental class learning outcomes presented in Figure 1.

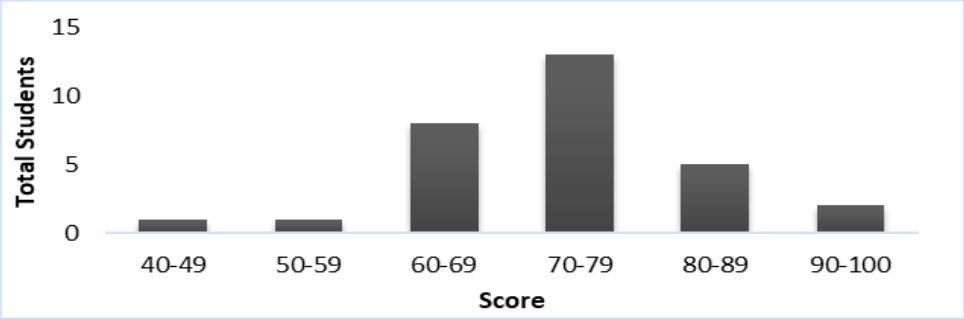

Figure 1. Histogram Graph of Experimental Class Student Learning Outcomes

Furthermore, the description of student learning outcomes in the control class. Based on the calculation, the results of learning basic knowledge of mechanical engineering using the conventional learning model are obtained. The lowest score was 30 and the highest score was 90. The mathematics learning outcomes of the experimental group students were presented in the form of a frequency distribution table. In the frequency distribution table, it can be seen that the most scores obtained by the control group students at intervals of 60-69 are 33.33%, students who get scores above the average are 42.32%, namely from the intervals 70-79, 80-90, while students who scored below the average were 56.65% from the intervals 30-39, 40-49, 50-59, 60-69.

Table 2. Frequency Of Control Class Learning Outcomes

Score	Median	Absolute Frequency	Precentage %
30-39	35,5	1	3.33%
40-49	44,5	2	6,66%
50-59	54,5	4	13,33%

Score	Median	Absolute Frequency	Precentage %
60-69	64,5	10	33.33%
70-79	74,5	8	26,66%
80-90	84,5	5	16,66%

The calculation to find the central tendency of the score of the results of the basic knowledge of mechanical engineering uses the SPSS 22 for windows program. From the results of these calculations, the average value (Mean) is 63.67, the median is 62.50, the mode is 60, the standard deviation is 12.658, the variance is 160.230, the range is 60, the minimum is 30 and the maximum is 90. Data on student learning outcomes in the experimental class and control class that have been described in the form of a frequency distribution table, then tested the assumptions.

The assumption test includes two tests, namely the normality test and the homogeneity test. The normality test was conducted to determine whether the post test results of the experimental class and control class were normally distributed or not. The test used to determine whether this data is normal or not is using the Kolmogorow-Smirnov test (Mishra et al., 2019), with the help of the SPSS 22 for windows program. The data is normally distributed if the significance number obtained is more than 0.05 at a significant level of 5%. From the results of the normality test conducted, a significant score for the normality of learning outcomes for the experimental class was 0.082 and the control class was 0.072. The significance value of the two classes exceeds 0.05, so it can be concluded that the post-test learning outcomes of the experimental class and control class students are normally distributed.

Furthermore, homogeneity test was conducted, the purpose of homogeneity test was to determine whether the sample had the same or homogeneous variance (Lee & Lee, 2018; Trusina et al., 2017). The homogeneity test was carried out with the help of the SPSS 22 for windows program, at statistical levels. The decision-making criterion for the homogeneity test is if the significance value is 0.05, it can be concluded that the variance group is different, and if the significance value is 0.05, it can be concluded that the variance group is the same or homogeneous (Kholilurrohman & Suryadarma, 2019). From the results of the homogeneity test that has been carried out by the experimental class and the control class (R. S. Sari et al., 2023), the results show a significance value of 0.628 0.05. Thus, the experimental group and the control group have the same or homogeneous variance.

Hypothesis testing is done by using the t test (Independent sample T-Test). The analysis of the calculation results of the Independent sample T-Test was carried out with the help of the SPSS 22 for windows program. The decision-making criteria for the test (Independent sample T-Test) that is, if the significance value (2-tailed) <0.05 then Ho is rejected and Ha is accepted otherwise, If the significance value (2-tailed) > 0.05 then Ho is accepted and Ha rejected. From the results of the analysis of the Independent sample T-Test test with the help of the SPSS 22 For windows program, the sig value was obtained. (2-tailed) that is equal to 0.038 at a significance level of 5%, with a value of sig. (2-tailed) obtained that is equal to 0.038 can be concluded that Ho is rejected and Ha is accepted, with these criteria it can be concluded that there are differences in the learning outcomes of students' basic knowledge of mechanical engineering in the experimental class and the control class.

This difference can also be seen from the average value of students, in the experimental class the average value of students is 70.50, while in the control class the average value of students is 63.67. The difference in learning outcomes from the two classes was based on differences in the treatment given to the basic knowledge of mechanical engineering subjects, the treatment given to the experimental class was the jigsaw learning model, while the treatment given to the control class was the conventional learning model.

Discussion

The application of the jigsaw learning model to the subject of basic knowledge of mechanical engineering is suitable because it is seen from the increase in student learning outcomes in the experimental class (Suparno et al., 2019). The average value obtained by students after receiving treatment in the form of teaching with the jigsaw model is 70.50, while the average value in the control class that receives treatment in the form of teaching with the conventional model is 63.67. This research was conducted with the aim of knowing whether there is a difference in the learning outcomes of students who follow the jigsaw type of cooperative learning model with the students who follow the conventional learning model at Vocational High School St. Alosius Ruteng. Based on the results of hypothesis testing that has been carried out with the help of the SPSS 22 For windows program, the sig value is obtained. (2-tailed) that is equal to 0.038. With these results, it shows that there are differences in the results of learning basic knowledge of mechanical engineering in the experimental class and the control class.

The jigsaw learning model in the subject of basic knowledge of mechanical engineering can increase student enthusiasm for learning. It is because cooperative learning groups students in the classroom into small groups so that students can work together to their maximum ability and learn from each other (Mari & Gumel, 2015; Wardani & Wiyasa, 2020; Wicaksono & Corebima, 2015). This activity causes students to be motivated to learn. The cooperative learning model is a learning model that is widely used and is of concern and is recommended by education experts (Heriwan & Taufina, 2020; Janattaka & Ghufron, 2014; Saputra et al., 2019). Previous research findings also state that the use of cooperative learning can improve student learning outcomes as well as improve social relations, foster an attitude of tolerance, respect the opinions of others, make students think critically, be able to solve problems, and integrate knowledge and experience (Leniati & Indarini, 2021; Wildawati et al., 2018). Other findings also state that cooperative learning can arouse students' enthusiasm for learning by using group discussion activities (Edriati et al., 2015; Effendi-Hasibuan et al., 2020).

The cooperative learning model is designed to take advantage of the phenomenon of cooperation in learning, which emphasizes the formation of relationships between students with one, the formation of democratic attitudes and behavior, and the growth of productivity in student learning activities (Hasibuan et al., 2020; M. K. Sari, 2014; Utomo et al., 2020). Cooperative learning is not just group learning (Wati & Anggraini, 2019; Widyaningrum & Harjono, 2019). The cooperative learning model's basic elements distinguish it from group division. The five elements of cooperative learning must be applied to achieve maximum results. First, in cooperative learning, task success depends on group effort (Putra et al., 2018; Subiyantari et al., 2019). The performance of each member determines the success of group work. Therefore, all group members will feel interdependent. Second, the group's success highly depends on each member (Nashirotun, 2020; Nurfitriyanti, 2017). Therefore, each group member has duties and responsibilities that must be carried out within the group. Third, cooperative learning provides broad opportunities for group members to interact and discuss to give and receive information from other group members (Kurniawati et al., 2017; Zakiah & Samlawi, 2019). Fourth, cooperative learning trains students to participate and communicate in learning activities actively. Fifth, Schedule a special time for the group to evaluate the group work process and the results of their collaboration to work together more effectively.

Cooperative learning is different from other learning models. These differences can be seen in the learning process, which places more emphasis on working with groups. The goals achieved are not only academic ability or mastery of the subject matter but also the presence of this element of cooperation which is the hallmark of cooperative learning (Maielfi & Wahyuni, 2020; Yemi et al., 2018). Previous research findings state that the Jigsaw learning model requires each team member to help each other achieve learning goals (Alfaruqy, 2021; Maison et al., 2021). Other findings also state that each group member gives and receives so that each member can contribute to the group's success, thus increasing student collaboration skills (Nashirotun, 2020; Nurfitriyanti, 2017; Wicaksono & Corebima, 2015). The success of the group determines the success of cooperative learning. Therefore, the principle of success or cooperation needs to be implemented in cooperative learning. Considering that the jigsaw cooperative learning model can improve student learning outcomes for basic knowledge of mechanical engineering, it is recommended that teachers who specialize in these subjects develop this learning model (Jeschke et al., 2021). Moreover, other researchers who want to apply the jigsaw learning model will pay attention to the constraints that researchers experience when carrying out the learning process so that later better results are obtained (Alfaruqy, 2021).

4. CONCLUSION

Based on the results of hypothesis testing that has been done, it shows that there are differences in the results of learning basic knowledge of mechanical engineering in the experimental class and the control class. The jigsaw cooperative learning model can improve student learning outcomes for basic knowledge of mechanical engineering. The jigsaw-type cooperative learning model can increase student motivation so that it has an impact on increased student learning outcomes.

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