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Jigsaw Type Cooperative Learning Model with Crossword Puzzle; Implementation and Influence on Biology Learning Outcomes

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Abstrak

Tujuan penelitian adalah untuk mengetahui apakah penggunaan *Crossword Puzzle* yang dipadukan dengan Model Pembelajaran Kooperatif Tipe Jigsaw akan meningkatkan hasil belajar biologi siswa ketika mempelajari materi bakteri di SMA Negeri 2 Tondano. Penelitian ini dilaksanakan pada kelas X SMA Negeri 2 Tondano pada tahun pelajaran 2023/2024. Dua puluh siswa kelas XA dan dua puluh siswa kelas XB dipilih sebagai sampel penelitian. Derajat kebebasan pengujian hipotesis uji-t adalah n1 + n2 – 2 (20 +24 – 2) = 42, dan tingkat signifikansi yang digunakan adalah 0,05. Nilai t_{hitung} sebesar 22,55 dengan nilai t_{tabel} sebesar 2,018. T_{hitung} dicari dengan memeriksa nilai t_{hitung} dan t_{tabel}. Nilai t_{tabel}, menunjukkan H_1 diterima dan H_0 ditolak. Dengan demikian dapat dikatakan bahwa penggunaan model pembelajaran kooperatif tipe Jigsaw disertai teka-teki silang memberikan dampak terhadap peningkatan hasil belajar materi mikrobiologi di SMA Negeri 2 Tondano.

Kata Kunci: *Model Pembelajaran, Jigsaw, Crossword Puzzle, Hasil Belajar*

Abstract

The purpose of the study is to ascertain whether using crossword puzzles in conjunction with the Jigsaw Type Cooperative Learning Model will enhance students' learning outcomes in biology when studying bacterial material at SMA Negeri 2 Tondano. This study was carried out in SMA Negeri 2 Tondano's class X during the 2023/2024 academic year. Twenty pupils from class XA and twenty students from class XB were selected as research samples. The degrees of freedom for the t-test hypothesis testing were n1 + n2 – 2 (20 +24 – 2) = 42, and the significance level employed was 0.05. The tcount value was 22.55 with a ttable value of 2.018. Tcount was found by examining the t_{count} and t_{table} values. t_{table}, indicating that H_1 is approved and H_0 is refused. Thus, it can be said that the use of a cooperative learning model akin to the Jigsaw type with a crossword puzzle has an impact on enhancing learning outcomes in microbiological content at SMA Negeri 2 Tondano.

Keywords: *Learning Model, Jigsaw, Crossword Puzzle, Learning Results*

INTRODUCTION

Education is an effort made to develop the potential that exists in students. According to the Ministry of National Education in 2003 article 1 paragraph 1 of Republic of Indonesia Law no. 20 of 2003 concerning the National Education System which states that education is an effort carried out consciously and planned which aims to realize a learning atmosphere and teaching and learning activities so that students are active in developing their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals, as well as skills that are useful for society, the nation and the State (Mangelep, 2013; Arimadona, 2019).

Education aims to develop students' learning abilities, expand knowledge, and form students' character. Education that can make students have broad knowledge and skills, have a character that can be emulated, and be active in teaching and learning activities is an example of good education (Mangelep, 2015; Noor, 2020; Judijanto et al., 2023). *Learning* is an interaction between students and teaching staff and learning resources that occur in the environment where teaching and learning activities occur. In its application in everyday life, biology learning in secondary schools is expected to become a means used by students to study themselves and the surrounding environment (Nursyamsi et al., 2016; Mangelep, 2017).

Biology is a branch of science in the science department in high school. Biology is related to knowledge and understanding of nature, so Biology is not just about mastering facts, concepts, and principles but is also a discovery (Berutu & Tambunan, 2018; Mangelep et al., 2020). Bastiti in Nursyamsi, Corebima, and Susilo (2016) stated that some Biology teachers still use the same learning methods, which results in students feeling bored because the learning patterns are not varied. This results in students being less interested and even indifferent to the lesson, so many students need to pay more attention to the explanations given by the teacher. Students are also reluctant to express opinions or questions while learning is in progress, which shows that Biology learning at school has yet to become a means of improving student learning outcomes.

Based on the results of observations made at SMA Negeri 2 Tondano on Wednesday, July 26, 2023, especially in the Biology subject for class, Student motivation in learning is also still low. This is characterized by students' need for preparation and readiness when starting biology lessons. This situation is also supported by facts seen in class, including (1) Lack of questions and responses from students to the teacher, which indicates that students are less active in the learning process, (2) Lack of student attention to the material being presented (Febriani, 2021; Mangelep et al., 2023).

In Biology learning activities, especially in Bacteria material, students often need help understanding the lesson material provided by the teacher. The experiences experienced by students in studying bacterial material include difficulties in understanding the concept of classifying bacteria and difficulties in writing scientific names (Hidayatussaadah et al., 2016). Apart from that, other difficulties experienced by students in bacterial material are difficulties understanding the material, which mostly requires students to remember a lot, and students need more interest in reading (Temaya et al., 2023). The location of the difficulties in bacterial material, if sorted from difficult to moderate, is the sub-material of bacterial

characteristics, bacterial classification, bacterial reproduction, the role of bacteria, and the definition of bacteria (Rindiana & Rakhmawati, 2022).

To overcome this problem, it is necessary to apply learning strategies that can improve cognitive learning outcomes in students. One learning model that can be applied to improve student learning outcomes is the Jigsaw-type cooperative learning model (Tandi, 2020; Mangelep et al., 2023). Jigsaw-type cooperative learning is a learning model that, in its application, requires students to be responsible for their respective tasks and teach the material they have learned to friends in one group (Kahar et al., 2020; Mangelep et al., 2023).

A Crossword Puzzle is a medium consisting of boxes with two paths, namely horizontal and descending (Setiadi, 2021). In Crossword puzzles or crossword puzzles, several questions or words are the key to filling in the boxes provided (Muhafidin, 2018). Crossword puzzles are a learning strategy whose role is to review the material that has been presented. One review aims to make it easier for students to recall the material taught (Muhafidin, 2018; Mangelep et al., 2024).

Based on the results of previous research, Arimadona (2019) concluded that the average score obtained by students in the experimental class after being treated with the implementation of the Jigsaw type cooperative learning model with Crossword Puzzle in Biology learning was 84.7 higher, compared to the control class which was not given the treatment of implementing the Jigsaw type cooperative learning model with Crossword Puzzle with the average score obtained being 73.4. Based on the explanation above, researchers conducted research with the title "The Effect of Implementing the Jigsaw Type Cooperative Learning Model with Crossword Puzzles on Improving Biology Learning Outcomes on Bacterial Material at SMA Negeri 2 Tondano".

METHOD

The type of research used in this research is experimental research using Quasi-Experimental Design. Experimental research uses quasi because it has a control group but does not fully function to control external variables that influence the implementation of the research (Ando, 2021). In the research, two groups were formed, namely the experimental group and the control group, which were given treatment according to the research objectives. The results of the responses of the two groups were then compared (Priyono, 2016). This research was conducted on students in two classes. As an experimental class, the first class applies the Jigsaw type Cooperative learning model with Crossword Puzzle media. Meanwhile, the second class is a control class that applies a conventional learning model using the same material, namely bacteria.

This research was carried out in the even semester of the 2023/2024 academic year at SMA Negeri 2 Tondano, located in Minahasa Regency, South Tondano District, North Sulawesi. The population in this study were all students in class X of SMA Negeri 2 Tondano, which consisted of 2 classes, namely class The sample consisted of two classes, namely XA and XB, which were selected directly, namely class XA as the experimental group and XB as the control group.

The research design used was an experiment with a group pretest-posttest design (preliminary test - group final test). Research design The group pretest-posttest design consists of two predetermined groups. In this design, testing is done twice: an initial and a final test. The research design is presented in the following table.

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Experiment	O_1	X_1	O_3
Control	O_2	X_2	O_4

Source (Sugiyono, 2017)

Information:
O_1 = experimental class pretest
O_2 = control class pretest
O_3 = experimental class posttest
O_4 = control class posttest
X_1 = Learning using the Jigsaw-type cooperative learning model
X_2 = Learning using conventional learning models

In this study, the research instruments used to collect data were the Syllabus, Learning Implementation Plan (RPP), Student Worksheets (LKPD), and pretest-posttest questions in the form of essays of 10 numbers. The data collection techniques used in this research were pretest and posttest. Tests are used as a measuring tool to measure basic abilities and achievements (Arikunto, 2014). Data collection in this research was obtained by administering a pretest (initial test) and posttest (final test). In this research, a normality test and homogeneity test were carried out, and then a hypothesis test was carried out between the experimental and control groups.

RESULT AND DISCUSSION

Result

1. Description of Research Results

This research aims to determine the effect of implementing the Jigsaw Type Cooperative Learning Model with Crossword Puzzles on improving learning outcomes in Bacteria material at SMAN 2 Tondano. The research was conducted on Monday, February 12 2024 in the XB class room and Tuesday, February 13 2024 in the XA class room at SMAN 2 Tondano. Experimental classes were held at the 7th and 8th lesson hours. Control classes are held at the 5th and 6th hours. The research sample was 44 students divided into 24 students in the control class and 20 students in the experimental class. The results of the research are described as follows:

a. Description of Pretest Experimental Class Learning Results

From the results of the research data analysis carried out, it can be described in table form as follows:

Table 2. Description of Pretest Biology Experiment Class Learning Results

Statistic	Pre-test Score
Average	37,4
Median	38,5
Mode	32 dan 40
Minimum Score	28
Maximum Score	46
Standard Deviation	5,67

From the data above, it can be described the pretest experimental class biology learning results with a mean of 37.4, a median value of 38.5, the most frequently occurring values of 32 and 40, a standard deviation of 5.67. Meanwhile, the highest score was 46 and the lowest score was 28.

b. Description of Posttest Biology Experiment Class Learning Results

From the results of the research data analysis carried out, it can be described in table form as follows:

Table 3. Description of Post Test Biology Experiment Class Learning Results

Statistic	Pre-test Score
Average	85,6
Median	85,5
Mode	82
Minimum Score	91
Maximum Score	80
Standard Deviation	3,80

From the data above, it can be described the posttest experimental class biology learning results with a mean of 85.6, a median value of 85.5, a frequent value of 82, and a standard deviation of 3.80, while the highest score was 91 and the lowest score was 80.

c. Description of Pretest Control Class Biology Learning Results

From the results of the research data analysis carried out, it can be described in table form as follows:

Table 4. Description of Pretest Control Class Learning Results

Statistic	Pre-test Score
Average	16,21
Median	13
Mode	32
Minimum Score	3
Maximum Score	41
Standard Deviation	10,60

From the data above, it can be described the biology learning results of the pretest control class with a mean of 16.21, a mean of 13 frequently occurring values of 32 and a standard deviation of 10.60, while the highest score was 41 and the lowest score was 3.

d. Description of Posttest Control Class Biology Learning Results

From the results of the research data analysis carried out, it can be described in table form as follows:

Table 5. Description of Post Test Control Class Biology Learning Results

Statistic	Pre-test Score
Average	31,67
Median	30
Mode	30
Minimum Score	17
Maximum Score	50
Standard Deviation	8,13

From the data above, it can be described the posttest control class biology learning results with a mean of 31.67, with a mean value of 30 frequently appearing values and a standard deviation of 8.13. Meanwhile, the highest score is 50 and the lowest score is 17.

2. Analysis of research data

Table 6. Summary of Normality Test and Homogeneity Test Data

	Experiment Class	Control Class	Information
Normality test	*Pretest:* L_{count} *= 0.077* L_{table} *= 0.190*	*Pretest* L_{count} *= 0.026* L_{table} *= 0.186*	*Pretest* L_{count} *= 0.026* L_{table} *= 0.186*
Homogeneity Test	Experimental Class F_{count} = 2.226 F_{table} = 4.381 Control Class F_{count} = 1.7 F_{table} = 4.279		Because F_{count} < F_{table}, the variance of each class is homogeneous

a. Normality test

Based on the results of normality testing with the Liliefors test using Microsoft Excel, it was obtained that the experimental class pretest scores were normally distributed. From table 6 shows the pretest value for the experimental class L_{count} = 0.077 < L_{table} = 0.190 with a significance level of 0.05, it can be concluded that the experimental class has a normal distribution.

Based on the results of normality testing with the Liliefors test using Microsoft Excel, the control class pretest scores were normally distributed. From table 6 shows the

control class pretest value L_{count} = 0.026 < L_{table} = 0.186 with a significance level of 0.05, it can be concluded that the control class data is normally distributed.

b. Homogeneity Test

Test homogeneity using the F test with α = 0.05. From table 6 it shows that F_{count} = 2.226 < F_{table} = 4.381 with dk in the numerator = 1 and dk in the denominator n-1 so it can be seen that F_{count} < F_{table}. This shows that the population comes from homogeneous variance.

Homogeneity test using the F test with α 0.05. From table 6 it shows that F_{count} = 1.7 < F_{table} = 4.279 with dk in the numerator = 1 and dk in the denominator n-1 so it can be seen that F_{count} < F_{table}. This shows that the population comes from homogeneous variance.

c. Hypothesis testing

Hypothesis testing uses value data for both classes and t test with the following criteria:

$T_{count} \geq T_{table}$ then H_1 is accepted and H_0 is rejected

$T_{count} \leq T_{table}$ then H_0 is accepted and H_1 is rejected.

Table 7. Summary of Hypothesis Test Results Data

Statistic	Statistic Value	Testing Criteria
The number of students	20	Accept H_0 if $t_{count} < t_{table}$
Pretest and Posttest Average	48.2	
Experimental Class	45.54	Accept H_a if $t_{count} > t_{table}$
Difference between Pretest and Posttest Experimental Class	15.48	
Pretest and Posttest Average Control Class	155.04	
	27.73	
Difference between Pretest and Posttest Control Class	22,55	
	2,018	
tcount		
ttable		
Conclusion: Accept H_1		

Based on table 7 above, the t-test statistical test is at a real level of 5%, namely with the values $\bar{x}_1$ = 48.2, $\bar{x}_2$ = 15.48, s_1^2 = 45.54, s_2^2 = 155.04, n_1 = 20, n_2 = 24 obtained t_{count} = 22.55 and t_{table} = 2.018 so t_{count} > t_{table} then H_1 is accepted and H_0 is rejected. This means that there is an influence of the application of the Jigsaw type cooperative learning model on improving biology learning outcomes in bacterial material at SMA Negeri 2 Tondano.

Discussion

From the results of data analysis, it was obtained that tcount was 22.55. t_{count} (22.55) > t_{table} (2.018), which means that there is an influence of the application of the Jigsaw Type Cooperative Learning Model with Crossword Puzzles on improving Biology Learning Outcomes on Bacterial Material at SMA Negeri 2 Tondano. The data analyzed was obtained from data from experimental class (XA) and control class (XB) students. The average score of the control class in the pretest was 16.21, while the posttest was 31.67. The average score of the experimental class on the pretest was 37.4, while the posttest was 85.6.

The results of this research are in line with research conducted by Siska Arimadona (2019) which shows that there is an influence of the Jigsaw type cooperative learning model with Crossword Puzzle on student learning outcomes with the results of the hypothesis test obtained t_{count} = 5.50 and t_{table} = 1.67.

In line with the results of research conducted by Yohana Tandi (2020) which showed results at a significance level of 0.05, the learning outcomes data obtained t_{count} was greater than t_{table}, namely 4.087 > 2.018. This opinion is also supported by Eka Trisianawati (2016), who shows that student learning outcomes in experimental class 1 experienced a significant increase after being given treatment using the Jigsaw Type Cooperative learning model. The average learning outcome for experimental class 1 students, which was initially 14.67, has increased by 70.14, so the average score for the experimental class becomes 84.81. The learning outcomes of students in experimental class 2 after being treated using the discussion-lecture learning model also increased, although not as big as the increase in experimental class 1. The average learning outcomes of control class students, initially 13.13, increased by 63.00, so the experimental class's average score was 76.13. (3). From the results of data analysis using the Mann-Whitney test, it can be concluded that there are differences in the learning outcomes of students taught using Jigsaw-type cooperative learning with students taught using discussion-lecture learning on vector material.

Supported by Ummi Rosyidah (2016), the research results showed that the average pretest score was 64.07 for the learning outcomes test, and the average posttest score was 80.43. These results prove that the average learning outcomes of students taught using the Jigsaw-type cooperative learning model are higher before students are taught using the Jigsaw-type cooperative learning model. The results of calculating the posttest hypothesis using the t-test were at a significance level of 0.05, namely the results obtained from the t_{count} > t_{table} (1.879 > 1.701). From these results, it can be concluded that the hypothesis test rejects the null hypothesis H_0 and accepts the alternative hypothesis H_1. Furthermore, the results of this calculation prove that learning using the Jigsaw-type cooperative learning model positively influences learning outcomes.

In line with Darmawan Harefa (2022), based on the research results, it was found that the average score of the students had increased; where in the experimental class, the average initial test score was 73.30, while in the final test, it was 76.83. Furthermore, it can be seen from the results of the hypothesis test where the value of t_{count} > t_{table} (2.479 > 1.6749) which means that H_o is rejected and H_a is accepted, namely that there is an

influence of the jigsaw type cooperative learning model on the ability to understand natural science learning concepts.

As with the research results conducted by Lengkong (2023) examining the effect of the Jigsaw-type cooperative learning model on student learning outcomes, the Jigsaw-type cooperative learning model gives students more control in the learning activities. In the research conducted, the average posttest score for the experimental class was 84, and for the control class, it was 68.3. It can be concluded that the Jigsaw-type cooperative learning model influences student learning outcomes.

Thus, implementing the Jigsaw-type cooperative learning model improves biology learning outcomes on bacterial material. This can be seen in the higher learning outcomes of experimental class students compared to the control class. So, applying the Jigsaw-type cooperative learning model on bacterial material is effectively implemented at SMA Negeri 2 Tondano.

CONCLUSION

Based on the results of the research and data analysis that has been carried out, it can be concluded from the results of this research that there is an influence of the application of the jigsaw type cooperative learning model on improving biology learning outcomes on bacterial material at SMA Negeri 2 Tondano.

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