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Application of *e-Leaflet-Assisted* Jigsaw-Type *Cooperative Learning Model* to Improve Communication Skills of Class X Students on Ecosystem Materials

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Abstract
Background. To maximize both, a learning model is needed that can combine them, such as the *Jigsaw* learning model.
Aims. The objectives of this research are to: (1) identify the application of *Jigsaw* learning model assisted by *e-Leaflet* to communication skills; (2) analyze the differences in communication skills in students who use *e-leaflet* assisted learning model and those who use Leaflet assisted learning model; (3) analyze student responses during the implementation of *Jigsaw* learning model assisted by *e-Leaflet.*
Methods. This study used a quasi-experimental method with a *Nonrandomized Control Group Pretest-Posttest Design* involving two classes at SMAN 1 Dukupuntang. The sample was selected through *purposive sampling*. Data collection was done through observation, e-Leaflet product assessment, communication skills test, questionnaire, and interview.
Result. The results showed that: (1) the activity of students in the experimental class was excellent, and their communication skills were higher than those in the control class; (2) based on the analysis of test scores, there was a significant difference in students' communication skills; and (3) students' responses to the *Jigsaw* learning model assisted by *e-Leaflet* were high in terms of the effectiveness of *e-Leaflet*, involvement in the *Jigsaw* model and communication skills.
Conclusion. This study confirms that the Jigsaw learning model, assisted by e-Leaflet, can improve students' activity and communication skills, although its application still presents obstacles.
Implementation. The application of the Jigsaw model requires more attention to student characteristics and the provision of adequate facilities and technology to ensure the learning process runs optimally.

Keywords: jigsaw learning model, e-Leaflet, communication skills, ecosystem.

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INTRODUCTION

Many learning models have been employed in education to help students grasp the subject matter. The 21st century is one of the centuries in which developments in all fields are progressing rapidly. The emergence of the era of globalization has sparked a new era in education, which has led to the formulation of a new learning model in the 21st century. The abilities that students must have in facing the challenges of the 21st century include: (1) the ability to think critically and creatively, (2) the ability to communicate effectively, (3) the ability to innovate, (4) the ability to find solutions to a problem, (5) the ability to collaborate (Mashudi, 2021).

Based on the results of interviews conducted with students, it was found that students experienced difficulties in the learning process, especially in Biology subjects. This is due to the use of monotonous models and teaching media where students are only assigned to summarize without any explanation from the teacher. So that students hope the experience of learning Biology is not only limited to the classroom, but also extends to learning outside the classroom or through a practicum. Research conducted by Susanti (2023) found that practicum-based learning can improve student learning outcomes.

Cooperative learning is A learning model that prioritizes cooperation in achieving learning goals. Cooperative learning (*Cooperative Learning*) is a form of learning that involves learning and working in groups consisting of 4 to 6 people with a heterogeneous group structure. Not only that, cooperative learning can also encourage discussion activities in completing the tasks given. Cooperative learning is a method that effectively accommodates the diverse characteristics and backgrounds of students, as it improves achievement for both talented students, those with average skills, and those who are relatively low-skilled. In this study, a jigsaw-type cooperative model will be applied, where students will work in two groups: their group and an expert group. Through this jigsaw-type cooperative learning, students can learn from one another and have the opportunity to internalize the knowledge they have gained. Therefore, every student will have responsibility for the material that will be delivered to other students (Majid, 2013).

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Based on the results of initial observations conducted by researchers at SMA Negeri 1 Dukupuntang, it was found that the Jigsaw learning process has never been carried out again at the school. The results of a study conducted by Vanalita et al. (2014) showed an increase in communication skills and learning outcomes that increased significantly after the application of the Jigsaw model by 81.48% with an average n-gain of 0.57. Therefore, updates related to the learning model must be implemented to enhance the student learning experience and create a student-centered learning environment.

Students' communication skills are often a concern in the learning process, especially in the context of cooperative learning. The Jigsaw model encourages students to discuss and exchange ideas actively, thereby honing their speaking and listening skills. Research indicates that students who engage in cooperative learning tend to develop better communication skills compared to those in conventional learning (Raditya, 2023). Students' communication skills must be provided with learning stimuli that enable them to explore their abilities (Wahyuningsih et al., 2022). Students' communication skills can be affected by Internal factors, for example, student self-efficacy. According to the study's results, Astuti and Pratama (2020) found a positive and significant relationship between self-efficacy and communication skills.

The diverse teaching materials are the creative efforts of educators who help students understand and absorb learning materials. Teaching materials play a crucial role in the learning process; therefore, they must be prepared as thoroughly as possible so that the material provided can achieve its target (Murti, 2020). The application of technology in education, such as *e-Leaflet*, provides ease of access to information and increases students' interest in learning. *E-Leaflet:* As an interactive learning medium, it presents information in an engaging and easy-to-understand manner. This aligns with the current development of the times, which requires students to possess strong digital skills. Additionally, the use of e-Leaflet in the Jigsaw model can enhance collaboration among students, as they must share information to understand the material thoroughly. Previous research has demonstrated that the incorporation of digital media into learning can enhance student motivation and learning outcomes (Azhari, 2024).

Therefore, based on the problems the researcher identified at SMA Negeri 1 Dukupuntang, a problem that can be reviewed for further research is obtained, namely, the application of the assisted Jigsaw learning model E-leaflet to assess the improvement of students'

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communication skills in the Ecosystem material. The purpose of this study is to: (1) identify the application of the e-Leaflet-assisted jigsaw-type cooperative learning model to students' communication skills in ecosystem materials; (2) analyze differences in communication skills between students who applied the assisted Jigsaw learning model *e-Leaflet* and students who applied the Leaflet-assisted Jigsaw learning model; and (3) analyze students' responses to the application of the assisted Jigsaw-type cooperative learning model *e-Leaflet* in the learning process.

METHOD

The research method employed in this study is quantitative, utilizing a quasi-experimental research design. The research design used is a *Nonrandomized Control Group Pretest-posttest Design*, which consists of an experimental group and a control group.

Table 1. Research Design

Class	Pre-test	Treatment	Post-test
X-2	T1	X2	T2
X-1	T3	X1	Q4

Information:
T1= Initial test in class X 2
T2= Final test in class X 2 after treatment
T3= Initial test in class X 1
T4= Final test in class X 1 after treatment
X1= Use of *Leaflet teaching materials*
X2= Use of *e-Leaflet teaching materials*

This research was conducted at SMA Negeri 1 Dukupuntang and took place during the even semester of the 2024/2025 school year. The population is 1,275 students, and the population in class X. The sample used is a non-probability sample, which consists of two classes selected by purposive sampling, as follows: class X.1, with a total of 36 students, serves as the control class, and class X.2, with a total of 36 students, serves as the experimental class.

Data collection was carried out using the following instruments: (1) student activity observation sheets and product assessments *e-Leaflet* to measure communication skills; (2) description test to determine communication skills; (3) questionnaires and interviews to find out the supporting and inhibiting factors for the implementation of the assisted jigsaw-type

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cooperative learning model *e-Leaflet.* The data analysis techniques used are the Mann-Whitney Test, *Normalized Gain* (N-Gain), and a questionnaire. Before testing the hypothesis, the data used were validity tests, reliability tests, normality tests, and homogeneity tests.

RESULT AND DISCUSSION

Application of e-Leaflet-Assisted *Jigsaw Type Cooperative Learning Model* to Communication Skills

Results of Observation of Learning Activities and Assessment *of e-Leaflet Products*

Observation of student activities was conducted to determine the extent to which the stages of the Jigsaw model were applied in this study. This type of observation utilizes indicators in conjunction with Jigsaw models and communication skills during the learning process. The results of the observation of student learning activities in the experimental and control classes, as shown for each indicator, are presented in Figure 1. Below are the results of the first to third meetings.

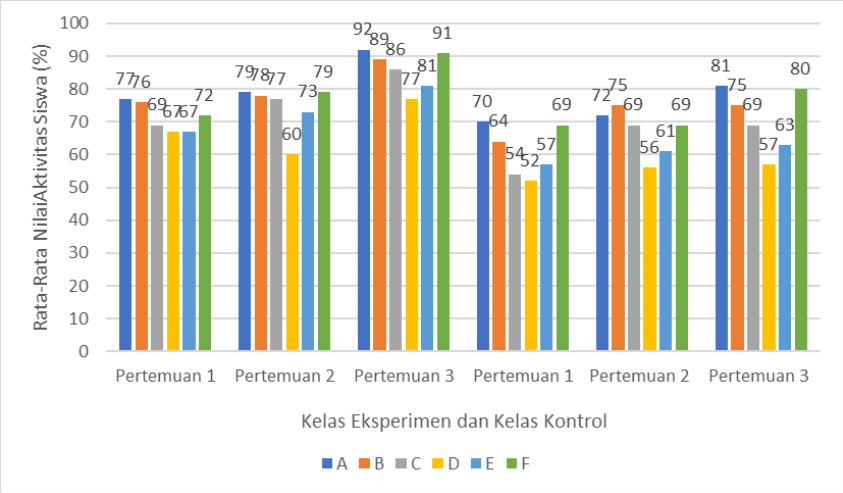

Figure 1. Average Chart of Student Activity Scores on Each Indicator

Information:
A: Group formation
B: Material distribution
C: Expert group discussion
D: Teaching back
E: Presentation of the results of the discussion
F: Evaluation

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Based on the results of observing student learning activities from the first meeting to the third meeting, it is evident that each class has both advantages and disadvantages in each observed indicator. Overall, the average scores in each indicator for both the experimental and control classes did not differ significantly and tended to fall within the good to excellent criteria. However, upon closer examination, the experimental class is slightly superior to the control class, as it achieves a higher average score in some indicators than the control class. This is due to the specific learning treatment.

Based on the results of observing student learning activities, it is evident that the observation process aligns with the syntax of the jigsaw model, which has been integrated with communication skill indicators. According to Lestari's (2021) opinion, the Jigsaw Learning Model is one of the learning models based on constructivist theory. In this model, the focus of learning is that students are given the obligation to make notes as learning material for the material learned from the expert group, which will later be shared with the original group.

Based on Figure 1, which displays the average value of student learning activities, it can be observed that the student learning activities in each meeting achieved a good average. However, in the experimental class, there was a decline. Several factors can cause this decline. According to Darmawan et al. (2021), there are several factors that can reduce students' motivation to learn. Where can these factors come from, internal or external? Internal factors that can affect learning motivation include interests, attitudes, and physical aspects. The external factors include the environment, as well as family, social, and school influences; learning methods, media use, and learning facilities, among others.

Material that is too complex can also be a factor in decreasing student learning activities. This is considered because materials that are too complex can be used as a challenge, especially if they do not have the necessary mental and emotional preparation (Wahyuni et al, 2024). The second meeting discussed the interaction between components, where, before studying the material, students were required to understand the basic concept of the ecosystem first. Although the first meeting received a good rating, it does not guarantee that students will be able to understand the material well in the second meeting.

The third meeting discussed the biogeochemical cycle. At this meeting, there was an increase in student learning activities both in the control and experimental classes. This is

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because the material taught is related to daily life, which results in students being more excited to learn about what will be discussed during the learning process. The results obtained are in line with Yusuf (2021), who stated that a comprehensive understanding of a material can enhance understanding and strengthen confidence in grasping the concepts presented.

Based on Figure 1, which shows the average chart of student learning activity scores, it can be seen that the group formation syntax obtained an overall higher average score compared to other syntaxes. This is because students have accepted and enthusiastically participated in the learning process. In this syntax, teachers focus on forming groups based on different characteristics. The goal is for students to develop responsibility and confidence. As a result, students will tend to be group-oriented rather than individualistic (Armanda, 2022).

The indicator of overall student learning activity that gets the lowest average is in the fourth syntax, namely, re-teaching. At this stage, the average obtained is less than optimal because students are less deeply involved. Where students still lack confidence in conveying information or material that has been understood and learned. This is in line with Puspitasari et al. (2022), which states that students who feel less confident are likely to experience this because they are afraid that when they speak, their speech will not be appreciated or accepted by their friends.

The assessment of *e-Leaflet* products is conducted to determine the average value of e-Leaflets for each observed indicator. Therefore, from the data, the extent of communication skills possessed by students after participating in four learning sessions will be known. *The e-Leaflet* product is assessed in relation to the ecosystem. This product is the final assignment that students complete after carrying out learning activities at the fourth meeting. The components assessed in the product assessment include the design used, creativity and language, materials, and cooperation. The results of the product assessment for each component are presented in Figure 2.

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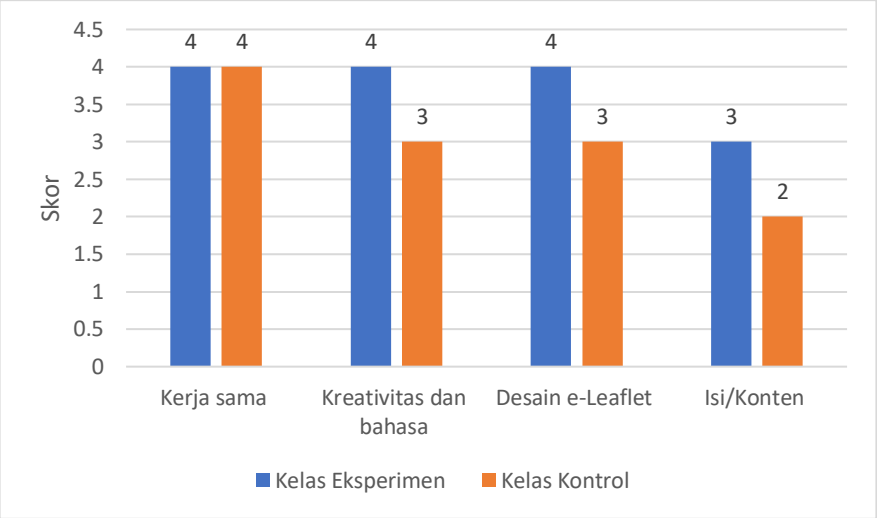

Figure 2. *e-Leaflet Product Results*

Based on Figure 2, it is known that the experimental class excels in creating *e-Leaflets*, while the control class excels in terms of cooperation. The lowest aspect is in the control class, namely the content/content aspect. This product is used as a final project completed in class.

Based on the results of *the e-Leaflet* assessment, although it is known that the average values of the highest and lowest indicators, each class also tends to have difficulties in compiling or making *the e-Leaflet*. The experimental class and the control class have an advantage in terms of cooperation, but are constrained by the material or content. The tendency of students to be constrained in compiling material may occur. This aligns with Jundu et al. (2020), who explained that the material in the teaching resources must be able to provide new experiences. The preparation of the material must also be adjusted systematically, sequentially, and from simple to complex concepts.

Based on the observation of students' communication skills from the first to the third meeting, it is evident that each class has both advantages and disadvantages in each observed indicator. Overall, the average scores in each indicator for both the experimental and control classes did not differ significantly and tended to fall within the "good" and "excellent" categories. However, upon closer examination, the experimental class is slightly superior to the control class, as it achieves a higher average score in some indicators than the control class. This is due to the specific learning treatment.

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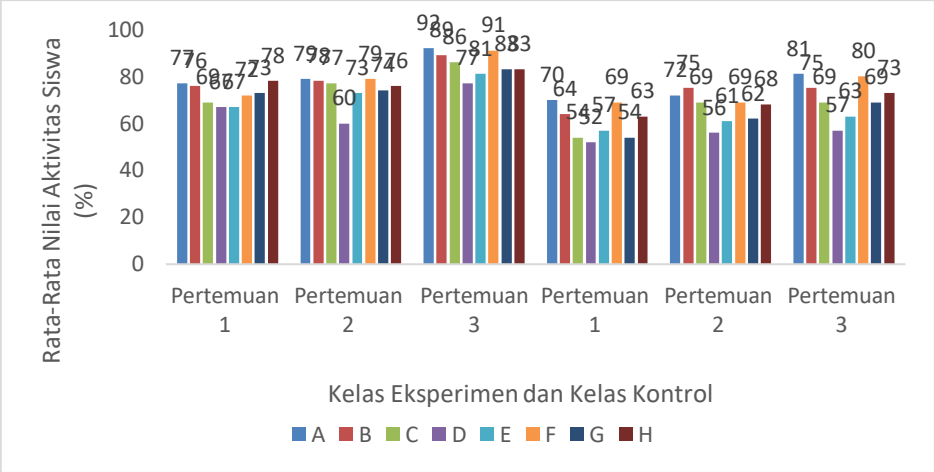

Figure 3. Average Chart of Student Activity Scores on Each Indicator

Information:
A: Use of appropriate and easy-to-understand language
B: Good articulation clarity
C: Delivery Method
D: Ask a question
E: Provide feedback
F: Good use of language
G: Write down the solution accurately and clearly
H: Organizing the concept

Based on Figure 3, which displays a diagram of the average value of students' communication skills, it can be seen that the indicators of verbal communication skills obtain lower scores compared to writing skills. This is because students with strong oral communication skills tend to be very dominant. Which teaching and learning activities with the discussion method do not increase oral communication skills? This aligns with Afiefah's (2014) opinion that the weakness of the discussion method is that it is dominated by students who are bold and have become accustomed to speaking. So that students who are quiet and shy will not use the opportunity to speak, which results in not all students daring to express their opinions.

This finding is also in line with Hakim et al. (2021), who suggest that active student participation in class discussions is linked to improved student achievement. This is due to changes in each student's achievement related to the quality of class dialogue. Then, students who lack effective communication in learning tend to exhibit lower learning achievement; on

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the other hand, students who have effective communication in learning tend to show higher learning achievement. Therefore, the high and low learning achievement is influenced by the communication skills that students possess during the learning process.

Furthermore, the results of Fatmadewi's (2019) research indicate that implementing an effective learning model can have a positive impact on students' communication skills and academic achievements. According to Iftitah (2019), the existence of questions and answers in discussions can also have a positive influence on students' oral communication skills. Not only that, oral communication skills have many factors. These factors can be categorized into two groups, namely inhibiting factors and supporting factors. Factors that can hinder oral communication skills in the learning process are in the form of a classroom environment that does not support student activeness as a form of oral communication skills in the learning process in the classroom, such as teachers who do not provide opportunities to be active and do not appreciate students' skills and classmates tend to mock their friends who are active during the learning process. Factors that support the high level of students' verbal communication in the classroom include teachers' respectful attitudes towards students and a supportive classroom environment (Goss, Sonnemann, & Griffiths, 2017). In addition, teachers' expectations of students also affect students' activeness in the classroom (Papageorge & Gershenson, 2016).

Difference in Communication Skills between the Experimental Class and the Control Class

The data processing process is assisted by the use of the IBM SPSS Statistics 27 and Microsoft Excel applications. To determine the difference between the results of the description test in the experimental and control classes, a hypothesis test was conducted. Before conducting a hypothesis test, the validity of the questions is first assessed using various methods. Both test instrument validity methods include expert and empirical validity tests.

Descriptive Analysis Results

Table 2. Results of Descriptive Analysis on Students' Communication Skills Scores

	N	Range	Minimum	Maximum	Mean	Standard Deviation

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Pretest Experiment	36	55	33	88	68,28	15.434
Posttest Experiment	36	35	63	98	86,97	8.286
Control Pretest	36	47	18	65	26,97	10.146
Posttest Control	36	45	20	65	50,28	11.323
Valid N (listwise)	36					

Source: Data processed using *IBM SPSS Statistics 27*

Based on Table 2 of the descriptive analysis results above, it is evident that the results of the descriptive analysis indicate a difference in the values achieved by the experimental and control groups at both the *pretest* and *posttest* stages. The average *pretest score* indicated that the two groups had very different starting points. However, after the administration of the treatment, *the posttest scores of the experimental group showed an improvement that exceeded those of* the control group, thus suggesting that the treatment given to the experimental group resulted in a more significant improvement in communication skills compared to the control group.

To determine the difference in learning with the e-Leaflet-assisted jigsaw model on communication skills, statistical testing is necessary on learning test scores obtained through pretest and posttest activities. The first statistical test was conducted on the results of the communication skills test, specifically a descriptive statistical analysis of the test scores. Based on Table 2. There are differences between the two groups. The control class got a higher posttest average compared to the experimental class posttest average. Meanwhile, the results of the pretest showed the opposite, with the experimental class achieving a higher average pretest score than the control class.

The difference and the opposite results were due to the experimental class using more innovative and interactive teaching materials, while the control group used commonly used teaching materials. According to Romansyah (2016), the selection of appropriate teaching materials and models has been proven to encourage students to achieve their learning goals. The selection of teaching materials is adjusted to the principles of relevance, consistency and adequacy.

Homogeneity Test Results

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The test is followed by conducting a statistical analysis of the prerequisite test to determine the hypothesis to be tested. Based on Table 3, the homogeneity test results are available for both the experimental and control class test data. The results indicate that the data variance is homogeneous, thus meeting the homogeneity assumption. Furthermore, in Table 4, the results showed that normality testing was not met, as the pretest and posttest distributions in both the experimental and control classes were not normal.

Table 3. Homogeneity Test Results on Students' Communication Skills

		Living Statistic	df1	df2	Sig.
Valu e	Based on the Mean	2.508	1	70	.118
	Based on the Median	3.130	1	70	.081
	Based on Median and with adjusted df	3.130	1	68.530	.081
	Based on the trimmed mean	3.125	1	70	.081

Source: Data processed using *IBM SPSS Statistics 27*

Based on Table 3, which presents the results of the homogeneity test using the Levene test, it is evident that the significance value (Sig.) in all calculation methods (mean, median, median with adjusted degrees of freedom, and trimmed mean) is greater than 0.05. This shows that the variance of communication skills data between the pretest and posttest groups is homogeneous. Thus, the homogeneity assumption is met, allowing statistical analysis to be carried out using a parametric approach to test the average difference in students' communication skills before and after the application of the Jigsaw model.

Normality Test Results

The normality test is based on and refers to the Shapiro-Wilk test. In the research conducted, 36 people were used as samples in each class. This indicates that the number is below 50, so the determination of whether the data is normal or not refers to the Shapiro-Wilk type normality test. The Shapiro-Wilk normality test is selected for the study due to its characteristics of being suitable for small samples and high sensitivity in detecting deviations from the normal distribution (Ismail, 2022). The results of the normality test for communication skills are presented in Table 4.

Table 4. Normality Test Results on Students' Communication Skills

Class	Shapiro-Wilk

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		Statistics	Df	Sig.
Result	Pretest A (Control)	.688	36	<.001
	Posttest A (Control)	.911	36	.007
	Pretest B (Experiment)	.890	36	.002
	Posttest B (Experimental)	.835	36	<.001

Source: Data processed using IBM SPSS Statistics 27

Based on Table 4 above, where the results of the normality test using Shapiro-Wilk are known, the significance value (Sig.) for the pretest and posttest of the experimental and control groups is less than 0.05. This shows that the pretest and posttest data in both groups are not normally distributed. Therefore, since the data do not meet the assumption of normality, nonparametric statistical analysis should be considered to test for differences in students' communication skills before and after the application of the Jigsaw model. The nonparametric hypothesis test used is the Mann-Whitney Test.

Mann-Whitney Test Results

In this study, the Mann-Whitney test can be used to assess the difference in students' communication skills between the experimental group, which used the e-Leaflet-assisted Jigsaw model, and the control group, which used the Leaflet-assisted Jigsaw model, after treatment. The results of the Mann-Whitney test can be presented in Table 6.

Table 5. Mann-Whitney Test Results on Students' Communication Skills

	Value
Mann-Whitney U	5.500
Wilcoxon W	671.500
Z	-7.260
Asymp. Sig. (2-tailed)	<.001

Source: Data processed using *IBM SPSS Statistics 27*

Based on Table 5 above, the Mann-Whitney test results in SPSS are based on the Asymp value. Sig. (2-tailed) or p-value contained in the output of the test result. If the p-value ≤ 0.05, then the null hypothesis (H0) is rejected, which means that there is a significant difference

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between the two unpaired data groups. However, if the p-value > 0.05, then H0 fails to be rejected, which means that there is no significant difference between the two groups. The results of the Mann-Whitney test produce an Asymp value. (2-tailed) that is less than 0.05. Because the significance value was less than 0.05 ($p<0.05$), it can be said that there was a significant difference between communication skills in the experimental group and the control group based on the test scores.

Based on the results of the prerequisite test, it was found that the data were homogeneous but not distributed normally. Based on this, the hypothesis test chosen is a nonparametric statistical test. The selected nonparametric statistical test is the Mann-Whitney Test. Based on the test results presented in Table 6, it is evident that there is a significant difference in the communication skills between the experimental group and the control group.

The findings of the study are in line with research conducted by Sari, et al., (2021) which found that the application of *e-Leaflet-assisted* learning has a significant influence on biology learning outcomes on environmental change materials. Furthermore, Gaffar (2017) also found that the application of the jigsaw learning model as one of the interactive learning models that showed positive results succeeded in improving students' communication skills in the material of the human circulatory system.

Normalized Gain *(N-Gain)* Analysis

The results of the N-Gain analysis obtained in each class can be presented in Figure 4.

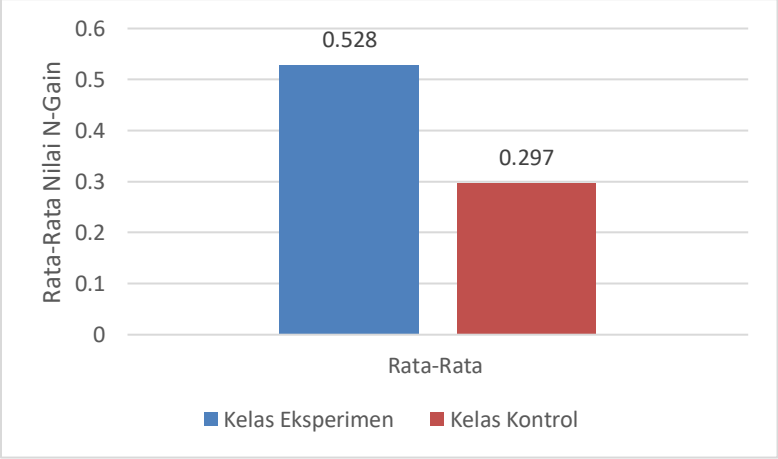

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Figure 4 N-Gain Value Diagram

Based on Figure 4 above, it is known that the difference between the N-Gain value in the experimental class and the control class is 0.231. Thus, it can be said that the experimental class demonstrated higher communication skills compared to the control class, although the average difference in the N-Gain score obtained was not substantial. Therefore, the application of the e-Leaflet-assisted Jigsaw learning model in the experimental class increased communication skills, as evidenced by the higher average N-Gain value of the experimental class compared to the control class.

Based on the graph in Figure 5, it can be seen that in the experimental class, the number of students with an N-Gain score in the failure category is two. There are eight students with low N-Gain scores, 12 students with medium N-Gain scores, and 14 students with high N-Gain scores. As for the control class, the number of students who had an N-Gain score in the failed category was five, while students with a low N-Gain score totaled nine, those with a medium N-Gain score were 22, and there were none with high N-Gain scores.

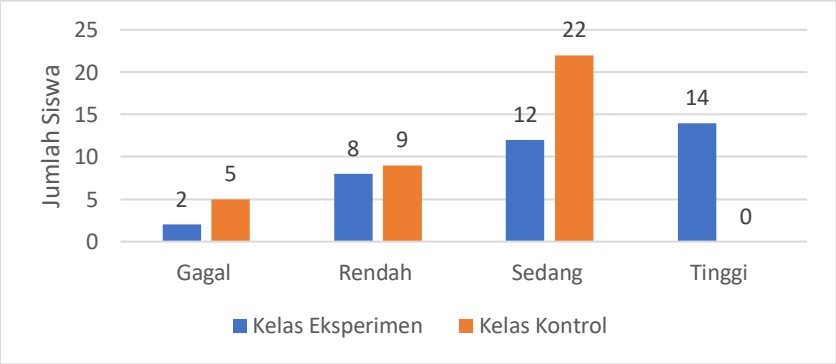

Figure 5 N-Gain Value Category Diagram

The following statistical test is the *Normalized Gain* (N-Gain) test, as described by Sundayana (2016). The N-Gain test can provide an overview of the improvement in communication skills score between before and after implementation. Based on the tests carried out, it can be observed that the average N-Gain value obtained in the experimental class is 0.528 in the medium category. In contrast, the control class has an average value of 0.297 in the low

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category. The difference in the score between the two is 0.231, indicating that the application of the e-Leaflet-assisted Jigsaw learning model in the experimental class has improved students' communication skills, as evidenced by the higher average N-Gain score.

The results of this study demonstrate a significant improvement in students' communication skills following the application of the e-Leaflet-assisted Jigsaw model. These findings align with research conducted by Vianney et al. (2025), which also found that the Jigsaw model can enhance students' skills. However, previous research was conducted to measure learning outcomes using media such as animated videos and LKPD live worksheets. This shows that the effectiveness of the Jigsaw learning model can be applied to different types of student skills.

Findings from other research results, conducted by Oktaviani (2022), stated that implementing the PBL learning model can improve students' communication and collaboration skills through *Lesson Study*. Another finding is that the results of research from Hasandi et.al (2024) stated that the Jigsaw learning method is significantly effective in improving students' collaborative communication skills. Through the application of this method, students not only gain a deeper understanding of the material but also engage in group discussions that encourage them to exchange opinions, listen actively, and collaborate on completing group assignments. This method has also been proven to foster an inclusive learning environment, where each student contributes to achieving the learning objectives.

Student Responses in the Application of the e-Leaflet-Assisted *Jigsaw Type Cooperative Learning Model*

Questionnaire data from the experimental class were collected to determine how and to what extent students responded to the application of the e-Leaflet-assisted jigsaw model in enhancing their communication skills. The questionnaire contains 25 (twenty-five) positive and negative statements containing: (1) Students' communication skills; (2) Involvement in jigsaw models; and (3) Effectiveness of *e-Leaflets*. The data from the response questionnaire for each indicator are presented in Figure 6 below.

Based on Graph 6, it can be seen that the communication skills possessed by students are in the good category. This is indicated by results greater than 60. The highest results were in the indicators of good articulation clarity and accurate and precise problem-solving, with scores

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of 84.50% and 84.30%, respectively. Based on Figure 7, it is evident that there is an average difference between oral and written communication skills. In verbal communication, they are more confident and comfortable, with a result of 79.86%. It can be concluded that they have good oral communication skills compared to their writing skills.

Based on Figure 8, student involvement in the jigsaw model in the student activity statement has high enthusiasm and involvement in the jigsaw model is in the high category. The ability of students to interact with other members of the group shows results with high criteria. Students are active in sharing information and discussing with group members with high criteria. This means that in student activities when sharing information and discussing increases when these activities are carried out by discussing. In effectiveness, *e-Leaflets* show results with an average of 81.5% or can be categorized with high criteria.

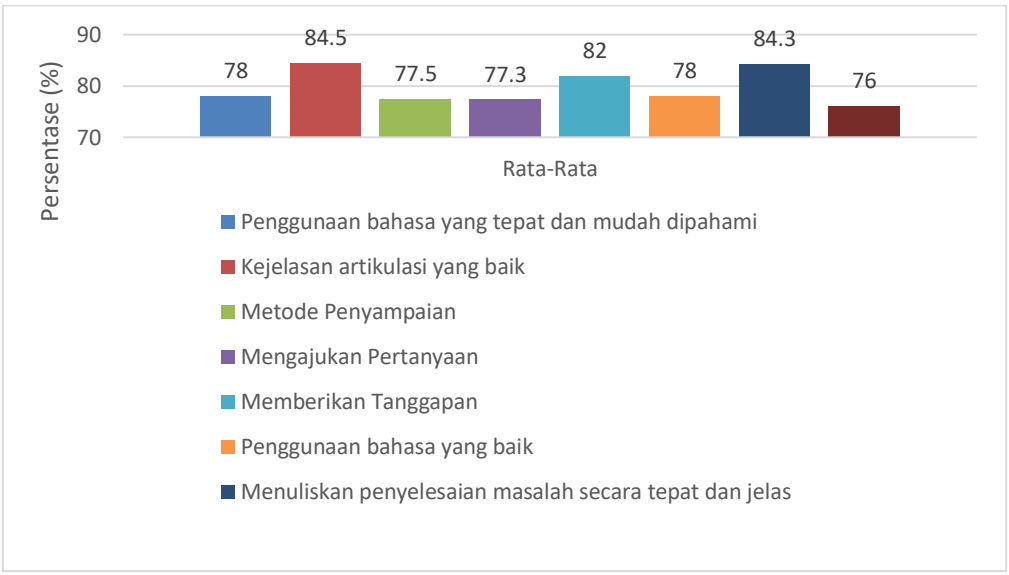

Figure 6 Oral and Written Communication Skills

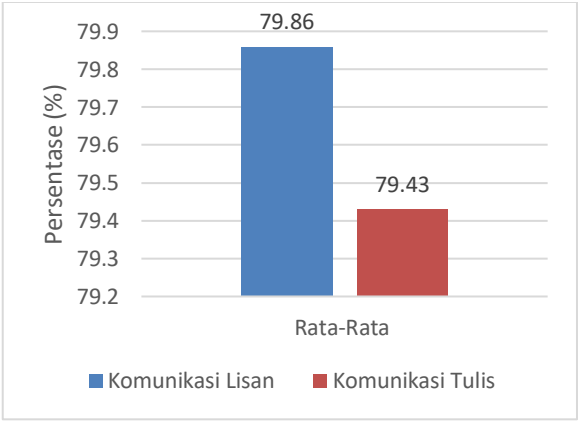

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Figure 7: Average Difference in Oral and Written Communication Skills

Based on Figure 9, the recapitulation of the questionnaire results for the e-Leaflet-assisted jigsaw learning module shows a different value. The communication skills indicator obtained a result of 80.556%. The average involvement in the jigsaw model has increased, resulting in a 81.134% increase. Meanwhile, the effectiveness of *e-Leaflets* has a high value of 81.424%. So it can be concluded that the e-leaflet-assisted jigsaw learning model provides a positive response to the application of the e-leaflet-assisted Jigsaw learning model.

. The questionnaire instrument is prepared based on certain indicators to determine students' responses in the learning process. According to Slameto in Wardhani (2024) states that students' conditions that include health, intelligence, and psychological well-being can have a significant influence on their academic success. Based on this statement, a questionnaire is needed to measure students' responses to their physiological and psychological responses.

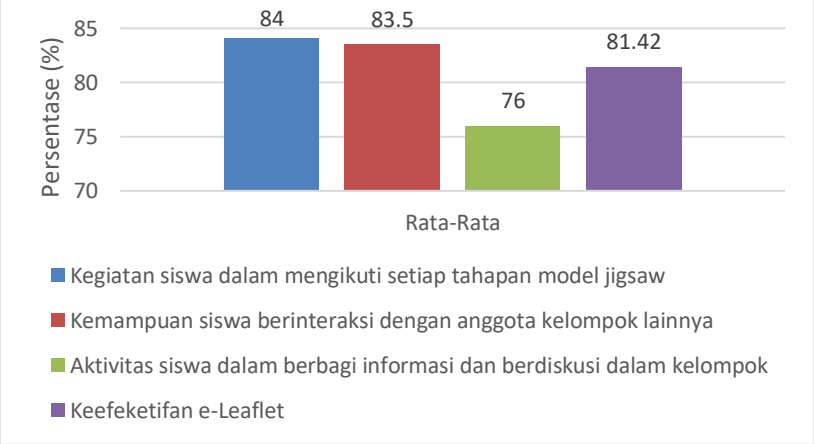

Figure 8 Involvement in Jigsaw Models and the Effectiveness of *e-Leaflets*

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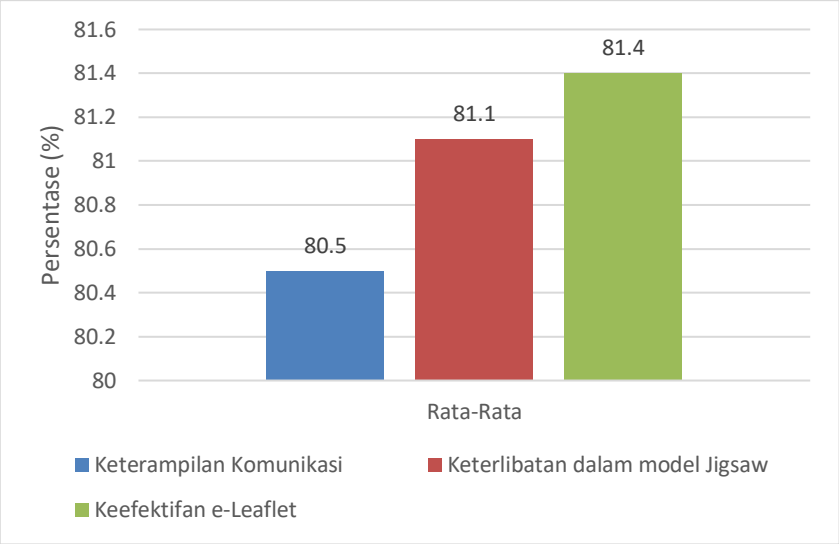

Figure 9: Average Questionnaire Recapitulation

Based on the response questionnaire used, the results obtained in the first indicator, namely communication skills, received a score in the perfect category, which indicates that the communication skills they have already exist but need to be further developed. The results obtained in the second indicator regarding the Jigsaw model received a score in the perfect category, indicating that the use of the learning model will significantly impact student readiness and response.

Based on the questionnaire responses to the third indicator related to the effectiveness of e-Leaflets, it appears that the use of e-Leaflets implemented is good, but requires further consideration and refinement. This aligns with the findings of Atikah (2023), which suggest that access to such information can enhance a person's knowledge and ultimately lead to more positive health-related behavior. Further research consistent with this study, conducted by Al Rahmad (2021), concluded that teaching using leaflets has a significant influence on the knowledge of elementary school students.

It can also be seen that other factors that can affect learning with a jigsaw model, such as the influence of the classroom environment or the role of teachers in supporting its implementation, can improve students' communication skills. This is based on the results of the interview, where the teacher's role in learning is not clear when the method provided is just a

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summary without further explanation. Of course, this confuses students, which will later have an impact on their learning outcomes (Hasandi et al., 2024).

CONCLUSION

The application of the jigsaw learning model has been proven to have a positive influence on students' communication skills, with a significant difference in communication skills observed between students who follow the e-Leaflet-assisted jigsaw learning model and those who follow the leaflet-assisted jigsaw learning model. The students' response to the application of the e-Leaflet-assisted jigsaw-type cooperative learning model is very high. However, there are obstacles, such as a lack of confidence and being more comfortable communicating with friends than with teachers. Therefore, the application of the Jigsaw model requires more attention to student characteristics and the provision of adequate facilities and technology to ensure the learning process runs optimally.

BIBLIOGRAPHY

Afiefah, N. (2014). Learning with the Class Discussion Method. *Journal of Tarbawiyah,* 11(1), 53-65.

Al Rahmad T, Fadjri, Y. (2021). Socialization of diet and sedentary in preventing obesity problems in elementary school children in Banda Aceh City. *J PADE Mass Relations and* Education.1(2), 62–66.

Armanda, N. (2022). *Application of Learning Model: Jigsaw*.

Astuti, B., Anggi I. P. (2020). The relationship between self-efficacy and students' communication skills. *Journal of Educational Research*. 13(2), 147-155. http://journal.uny.ac.id/index.php/jpip.

Atikah, E., Anggraeni, R. D. Fitriani, D. R. (2023). The Relationship of E-Leaflet Education to Students' Knowledge of Adolescent Anemia at SMK Sehati in 2023. *Journal of Innovation Research and Knowledge*. 2(9), 3813-3820.

Azhari, A. (2024). *The Influence of the Jigsaw-Type Cooperative Learning Model on Students' Communication Skills in Islamic Religious Education and Ethics at SMPN 164 Jakarta*. Thesis. Jakarta: Syarif Hidayatullah State Islamic University.

Darmawan, D., Issalillah, F., Retnowati, E., & Manuputun, D. R. (2021). The Role of School Environment and Teachers' Communication Skills on Student Learning Motivation. *Simki Journal of Pedagogy*. 4(1), 11-23.

Fatmadewi, V. Rohaeti, E. (2019). Application of the PQ4R Model Integrated with Mind Mapping Techniques on Learning Achievement and Communication Skills. *Journal of Mathematics Education*.

Gaffar, A.A. (2017). The application of the jigsaw model to improve students' communication skills on the material of the circulatory system in humans. *Journal of Bio Educatio*. 2(2): 21-26.

DOI: 10.62885/edusci.v2i6.790

Goss, P., Sonnemann, J., & Griffiths, K. (2017). *Engaging Students: Creating Calssrooms That Improve Learning*. http://www.grattan.edu.au/.

Hakim, F. R. (2021). The Urgency of Interactive Learning Models in Improving Student Learning Achievement and Motivation in Islamic Religious Education Subjects. *Tsamratul Fikri: Journal of Islamic Studies*. 15(1), 1-18.

Hasandi, R., Fadilah, Y., Solihah, I. A. (2024). The Effectiveness of the Jigsaw Learning Method in Improving the Collaborative Communication Skills of Grade V Students of Madrasah Ibtidaiyah. *BEST JOURNAL (Biology, Education Science & Technology)*. 7(2), 729-735.

Ismail, S. (2022). The Effect of the Use of the "Project Based Learning" Project-Based Learning Model on the Physics Learning Outcomes of Class X Students of Science High School Negeri 35 South Halmahera on the Concept of Straight Motion. *Scientific Journal of Educational Vehicles*. 8(5), 256-269.

Jundu, R., Nendi, F., Kurnila, V. S., Mulu, H., Ningsi, G. P., & Ali, F. A. (2020). Development of contextual-based science learning videos in Manggarai for students to learn during the Covid-19 pandemic. *LENS (Science Lantern: Journal of Science Education)*. 10(2), 63-73. https://doi.org/10.24929/lensa.v10i2.112.

Lestari, I. D., Ekanara, B., Purwaningsih, D. E. (2021). Efforts to improve the cognitive abilities of grade XI students of SMAN 4 Kota Serang through the application of a jigsaw-type cooperative learning model. *Indonesian Journal of Educational Development*. 1(4), 641-649.

Majid, A. (2013). *Learning Strategies*. Bandung: PT. Teenager Rosdakarya.

Mashudi, M. (2021). Modern Learning: Equipping Students with 21st Century Skills. *Al-Mudarris (Scientific Journal of Islamic Education), 4*(1), 93–114. https://doi.org/10.23971/mdr.v4i1.3187.

Murti, W & Anas, M. (2020). The Effectiveness of Talking Chips Type Cooperative Learning on Student Learning Outcomes. *Biotech Journal*. 8 (2), 80-94. http://journal.uin-alauddin.ac.id/index.php/biotek/article/view/16119.

Oktaviani, R. N. (2022). Implementation of the Problem Based Learning (PBL) learning model through lesson studies to improve communication and collaboration skills of STKIP BIM students. *ELSE: Journal of Elementary School Education and Learning*, 6(2), 257-276.

Papageorge, N. W., Seth G., Kyungmin, K. (2016). Do Teacher Expectations Matter?. http://conference.iza.org.

Puspitasari, R., Basori, M., Aka, K. A. (2022). Case Study of Lack of Confidence in High Class Students of SDN 3 Tanjungtani When Delivering Arguments in Class and Efforts to Foster Confidence. *BADA'A; Scientific Journal of Basic Education*. 4(2), 325-335.

Raditya, K. A., I. K. Gading., I. G. Ayu T. A. (2023). Jigsaw-Type Cooperative Learning Model Assisted by Powerpoint Media to Improve Collaboration Skills and Science Learning Outcomes of Grade V Elementary School Students. *Journal of Educational Media and Technology*. 3(2), 88-93.

Rohmansyah, K. (2016). Guidelines for the selection and presentation of teaching materials for Indonesian Language and Literature subjects. *Journal of Logic*. XVII(2), 59-66.

Sari, E. P., Syamsuriana B., Kasmawati. (2021). The Effect of Leaflet Learning Media on Biology Learning Outcomes. *Journal of Biology Education*. 4(1): 1-14.

DOI: 10.62885/edusci.v2i6.790

Sundayana, R. (2016). *Educational Research Statistics*. Alphabet.

Susanti, R. (2023). Practicum-based learning to improve learning outcomes with HOTS questions for science subjects. *TEACHING: Journal of Teacher Training Innovation and Education.* 3(1), 74-82.

Vanalita, M., Tri J., Rini R. T. M. (2014). *The Influence of the Jigsaw Learning Model on Students' Oral Communication Skills and Learning Skills*. Article. Bandar Lampung: University of Lampung.

Vianney, M., Bano, V. O., & Makatita, A. L. (2025). The application of a jigsaw-type cooperative learning model assisted by animation video media and LKPD liveworksheet to improve learning outcomes. *Biodic: Scientific Journal of Biology Education*. 11(1), 170-179.

Wardhani, H. S., & Wiarsig, C. (2024). Grade 1 Students' Learning Readiness Reviewed from Preschool Education Experience and the Role of Parents. *Consilium: Education and Counseling Journal*, 4(2), 172-184. https://doi.org/10.36841/consilium.v4i2.4686.

Wahyuni, A., Atmaja, G. T., Khasanah, K., Maulida, N. A., Zaini, M., Putra, A. P., & Khatimah, H. (2024). Improving Student Learning Outcomes About the Circulatory System with Cooperative Learning of CIRC and TGT Types. *Journal of Bio-Creaducation*. 1(2), 72-83.

Wahyuningsih, S. Karma, I.N, & Jaelani, A.K. (2022), *The Influence of Communication between Teachers and Students on Social Studies Learning Outcomes for Class IV SDN Cluster III Sekarbela, Mataram City*. https://jipp.unram.ac.id/index.php/jipp/is sue/view/23.

Yusuf, Y., Saibi, N., Ramli, M. R., & Nursia, N. (2021). Improvement of Activities and Learning Outcomes of Biology of Motion System Materials through the Application of the Murder Learning Model (Mood, Understand, Recall, Digest, Expand, Review). Biopedagogia, 3(2), 158-169. https://doi.org/10.35334/biopedagogia.v3i2.2336.

DOI: 10.62885/edusci.v2i6.790