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The Effectiveness of Jigsaw Cooperative Learning Model on Students' Appreciation of Biodiversity at Senior High School SMA Negeri 1 Rantau Utara

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Abstract

The low appreciation and understanding of students towards biodiversity, especially medicinal plants, pose challenges in biology education in Indonesia. Traditional teacher-centered methods emphasize memorization and lack a local cultural context. This study examines the effectiveness of the Jigsaw cooperative learning model based on ethnoscience in improving students' appreciation and understanding of medicinal plant biodiversity. A quasi-experimental design with a non-equivalent control group was used, involving grade X students of SMA Negeri 1 Rantau Utara. The experimental group used the Jigsaw model, while the control group followed conventional methods. Instruments included a Likert scale for appreciation and a multiple-choice test for understanding. Data analysis with SPSS 22.0 showed an average appreciation score of 67.03 and an understanding score of 87.66. The effectiveness test yielded a significance value of 0.000 (P < 0.005), indicating a significant improvement in the experimental group. The study concludes that the Jigsaw model enhances student engagement and appreciation of local knowledge, making it a relevant and contextual learning approach for strengthening students' understanding of Indonesia's natural and cultural heritage.

Keywords: *Biodiversity; Ethnoscience; Jigsaw Type Cooperative; Student's Appreciation and Understanding Material*

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INTRODUCTION

Education is the main pillar in creating a quality generation that contributes to the progress and development of a nation, a good education system in a nation will produce quality, responsible, competent, professional and reliable human resources. The quality of a nation is highly dependent on the quality of education provided, in

Indonesia education is very important because it is a measure of a person's success (Rahman et al., 2022), but the low quality of education at every level both in terms of economy and culture is a problem in the world of education in Indonesia today. This condition is an obstacle to improving the quality of education which ultimately has an impact on the low appreciation of students for learning that has the potential to build understanding in students. including in the field of biology, especially in the material on biodiversity, students still often show low appreciation for knowledge related to Indonesian flora, especially medicinal plants.

Learning about this material still focuses heavily on memorization and does not link concepts to the local context, as well as the learning approach which is still predominantly teacher-centered and does not actively involve students in the learning process (Taniatara & Wulandari, 2024). resulting in a lack of interest and understanding of students, even though this material is very important because it has ecological value, knowledge of local wisdom and culture and the use of traditional medicinal plants for public health. At the same time, it raises awareness of the importance of maintaining ecosystem balance and preserving local wisdom. Learning that is less interesting and contextual makes it difficult for students to understand biological concepts as a whole (Rahma, 2023). Therefore, it is important to apply a more innovative and contextual learning approach to increase students' appreciation and understanding of biodiversity, especially medicinal plants that have high cultural and ecological value in Indonesia.

As a megabiodiversity country, Indonesia has a wealth of flora including various types of medicinal plants that can be used in traditional medicine, by utilizing the Ethnoscience learning approach that can integrate the combination of science with local knowledge and culture, the ethnoscience approach can increase students' interest and understanding of science material (Firamadani, 2024)s. By studying local knowledge about medicinal plants, students can understand how the flora around them contributes to the health and well-being of the community, in this case it will create a deeper and more meaningful learning experience that allows students to see firsthand the relationship between theory and practice. In line with research (Akmal, 2021); (Nuralita, 2020) which shows that the ethnoscience approach can increase students' motivation, understanding, and appreciation of the subject matter. The Jigsaw-ype cooperative learning model based on ethnoscience is very suitable for application in learning material about biodiversity, especially medicinal plants. The jigsaw-type cooperative learning model is one of the effective learning models in increasing students' motivation and critical thinking skills (Kumalasari & Suyetno, 2022).

By dividing students into small groups, where each member is responsible for studying and delivering information about different medicinal plants, this learning model not only encourages cooperation and collaboration, but can also strengthen their understanding of the material being taught. This Jigsaw type cooperative learning model has been proven to improve students' learning, while encouraging the development of critical thinking and collaboration skills (Sukarmini et al., 2016). Therefore, this study was conducted to prove that the ethnoscience-based jigsaw on biodiversity material method can be an innovation in biology learning that is relevant to the Indonesian cultural context.

Based on this background, the main problem of the study is the low appreciation of grade X students of SMA Negeri 1 Rantau Utara towards biodiversity material, especially medicinal plants. Learning that still uses lecture methods and focuses on teachers hinders students' understanding of the importance of ethnoscience-based biodiversity. Therefore, this study aims to test the effectiveness of the Jigsaw cooperative learning model based on ethnoscience on biodiversity material, especially medicinal plants, in increasing students' appreciation and understanding.

This research is expected to motivate students to learn, understand the material more deeply, and appreciate Indonesia's biodiversity. In addition, this research attempts to integrate the Jigsaw learning model with the ethnoscience approach, which has not been widely applied in biodiversity learning in schools. This model is expected to not only improve students' academic understanding, but also students' appreciation of the knowledge of medicinal plants in the environment around students.

Education is the main pillar in creating a quality generation that contributes to the progress and development of a nation. A good education system in a country will produce quality, responsible, competent, professional, and reliable human resources. The quality of a nation is highly dependent on the quality of education provided. In Indonesia, education has a very important role because it is a measure of a person's success (Rahman et al., 2022). However, the low quality of education at every level, both in terms of economy and culture, is a problem in the world of education in Indonesia today (Ratnasari & Nugraheni, 2024). This condition is an obstacle to improving the quality of education, which ultimately has an impact on students' low appreciation of learning that has the potential to build their understanding.

One area that still shows low appreciation from students is biology, especially in the material on biodiversity. Students still often do not appreciate knowledge related to Indonesian flora, especially medicinal plants (Yuliana, 2017). Learning this material is still very focused on memorization and does not link concepts to the local context. In addition, the learning approach that is still dominated by teacher-centered methods inhibits the active involvement of students in the learning process (Taniatara & Wulandari, 2024). This results in a lack of interest and understanding of students, even though this material is very important because it has ecological value, contains local wisdom and culture, and is related to the use of traditional medicinal plants for public health (Mukti et al., 2022). In addition, this material can also increase awareness of the importance of maintaining ecosystem balance and preserving local wisdom. Learning that is less interesting and non-contextual makes it difficult for students to understand the concept of biology as a whole (Rahma, 2023). Therefore, a more innovative and contextual learning approach is needed to increase students' appreciation and understanding of biodiversity, especially medicinal plants that have high cultural and ecological value in Indonesia.

As a megabiodiversity country, Indonesia has a wealth of flora, including various types of medicinal plants that can be used in traditional medicine. By utilizing an ethnoscience-based learning approach that integrates science with local wisdom and culture, students' interest and understanding of science materials can increase (Firamadani, 2024). Through learning about local knowledge about medicinal plants, students can understand how the flora around them contributes to the health and well-being of the community. This approach creates a deeper and more meaningful learning

experience, allowing students to see firsthand the relationship between theory and practice. This is in line with research conducted by Akmal (2021); Nuralita (2020), which shows that the ethnoscience approach can increase students' motivation, understanding, and appreciation of learning materials.

The Jigsaw cooperative learning model based on ethnoscience is very suitable for application in learning about biodiversity, especially medicinal plants. The Jigsaw cooperative learning model is one of the effective learning models in increasing students' learning motivation and critical thinking skills (Kumalasari & Suyetno, 2022). In this model, students are divided into small groups, where each member is responsible for studying and conveying information about different medicinal plants. This learning model not only encourages cooperation and collaboration but also strengthens their understanding of the material being studied (Harefa et al., 2022). The Jigsaw cooperative learning model has been proven to improve student learning outcomes while encouraging the development of critical thinking and collaboration skills (Sukarmini et al., 2016). Therefore, this study was conducted to prove that the Jigsaw learning method based on ethnoscience in biodiversity material can be an innovation in biology learning that is relevant to the Indonesian cultural context.

Based on this background, the main problem in this study is the low appreciation of class X students of SMA Negeri 1 Rantau Utara towards biodiversity material, especially medicinal plants. Learning that still uses lecture methods and is centered on teachers hinders students' understanding of the importance of ethnoscience-based biodiversity. Therefore, this study aims to test the effectiveness of the Jigsaw cooperative learning model based on ethnoscience in biodiversity material, especially medicinal plants, in increasing students' appreciation and understanding.

This study is expected to motivate students to learn, understand the material more deeply, and appreciate Indonesia's biodiversity. In addition, this study also attempts to integrate the Jigsaw learning model with the ethnoscience approach, which has not been widely applied in biodiversity learning in schools. This model is expected to not only improve students' academic understanding, but also their appreciation of knowledge about medicinal plants in the surrounding environment (Septina, 2024).

METHOD

Research Procedure

This study uses a quasi-experimental research design by (Hastjarjo, 2019) involving experimental group and control group, Experimental group that received treatment with jigsaw learning model based on ethnoscience and control group that was taught with conventional learning. The design used in this study is Non-equivalent Control Group Design. This design was chosen because the researcher could not randomly divide students into experimental and control groups, but still wanted to compare the effectiveness of different learning models.

Table 1. Treatment

Group	Pre-test (A)	Treatment	Post-test (B)
Experimental Class	A_1	X (Ethnoscience-based Jigsaw Learning) a. Students are divided into small groups (home groups). b. Each member learns one part of the material about medicinal plants. c. They join an expert group to study the material in depth. d. Return to the original group and explain the material to other members. e. Group discussion and presentation of results. f. Evaluation is done with quizzes and group reflections.	B_1
Control Class	A_2	(Conventional learning methods)	B_2

Information :

Pre-test (A_1 and A_2)	**:** Pre-test was conducted on both groups (experimental and control) to assess students' initial abilities.
Treatment (X)	**:** The experimental class received *ethnoscience*-based Jigsaw learning treatment , while the control class did not receive this treatment and continued to use conventional learning methods.
Post-test (B_1 and B_2)	**:** After the treatment was completed, a post-test was conducted on both groups to measure changes or improvements in student knowledge.

In this study there are two variables, namely independent variables and dependent variables. The independent variable in this study is the Jigsaw Type Cooperative Learning Model based on ethnoscience , while the dependent variable is student appreciation of biodiversity material, namely medicinal plants. The population of this study was all grade X students at SMA Negeri 1 Rantau Utara, Padang Matinggi Village, Labuhanbatu Regency in the 2024/2025 academic year with a total of 360 students in 10 classes. From 10 classes, 2 classes were selected as samples. One experimental class (36 students) and one control class (28 students). The sampling technique used purposive sampling technique , namely a sample determination technique by targeting respondents with interest characteristics (Turner, 2022).

Data Collection and Data Analysis

This study uses a data collection technique involving the distribution of two instruments, namely the Understanding Test and the Student Appreciation Questionnaire for the Biodiversity Material, namely Medicinal Plants. Indicators for the Student Understanding Aspect are Conceptual knowledge (definition, classification of medicinal plants), Procedural understanding (how to identify medicinal plants), Problem solving (connecting biodiversity with health). Indicators for the Student Appreciation Aspect are Interest in local biodiversity, Awareness of the benefits of medicinal plants, Attitudes towards biodiversity conservation. Validity in

this study was conducted using this validity which used testing by 3 experts in the field of biology education. Reliability was tested with Cronbach's Alpha (value = 0.660).

According to Gantini (2022) The knowledge assessment test is carried out to determine the stage of students' mastery of factual, conceptual and procedural knowledge possessed by students, and to find out the extent to which students are able to do thinking skills that are in the low to high range. Therefore, according to Nee & Yunus (2020) adopted a multiple-choice test as a test of students' understanding. Student achievement scores are converted into a scale of 1 - 100, with each correct answer to the multiple-choice questions getting a value of 1, while the wrong answer is given a value of 0 , The student appreciation questionnaire in this study used a closed questionnaire by adopting a Likert scale questionnaire, by the researcher used to measure student appreciation for jigsaw-type cooperative learning based on ethnoscience on biodiversity material, especially medicinal plants with the following assessment criteria:

Table 2. Likert Scale for Jigsaw Cooperative Learning Model

Assessment criteria	Rating scale
Strongly agree (SS)	4
Agree (S)	3
Disagree (TS)	2
Strongly disagree (STS)	1

Source: (Nee & Yunus, 2020), All data analysis in this study was conducted using SPSS 22 for Windows.

The analysis process involved several stages. First, descriptive analysis was conducted to process data from the Likert scale and multiple-choice tests. This technique was used to calculate the mean and standard deviation, thus providing an overview of student responses to each item in the questionnaire and test results. Furthermore, to ensure the internal consistency of the student appreciation instrument, a reliability test was conducted using Cronbach's Alpha analysis. The instrument is considered to have good consistency if its reliability value is more than 0.7. The data on student appreciation and understanding scores were also tested for normality using Kolmogorov-Smirnov analysis, to determine whether the data was normally distributed.

In addition, Levene's Test was used to test the homogeneity of variance between the experimental and control groups. To test the hypothesis, two types of statistical tests were applied. In Likert scale data, paired sample t-test was used to compare the pre-test and post-test results in the experimental group. Meanwhile, in multiple-choice test data, independent sample t-test was used to compare the average scores of students' understanding between the experimental and control groups.

RESULT AND DISCUSSION

Posttest data of Jigsaw cooperative learning model on students' appreciation of biodiversity material, namely medicinal plants, from 36 students in the experimental class obtained an average value and standard deviation of 67.03 ± 3.699 overall while

in positive statements 33.81 ± 2.17544, this shows that the student appreciation score for positive statements is relatively high and quite consistent among respondents. While for the average value and standard deviation of negative statements 33.22 ± 2.72671, with a higher negative standard deviation value than positive statements indicating a slightly greater variation in student responses to negative statements, but the average value also shows a tendency to disagree with negative statements, which is still an indication of positive assessment of the aspects being measured. Thus, the average score approaching the highest value on positive statements, and a low value on negative statements, indicates that students have a good appreciation of the material or learning being assessed. The variation in negative statements is slightly larger, but still within limits that are not too deviant.

Table 3. Frequency and Percent of Student Appreciation

		Frequency	**Percent (%)**
Valid	Enough	31	86.1
	High	5	13.9
	Total	36	100

While the average value and standard deviation of the pre-test in the experimental class of 36 students were 67.01 ± 8.898, after being given treatment, the average value and standard deviation of the post-test in the experimental class increased to 87.66 ± 5.621, while in the control class of 28 students the average value and standard deviation of the pre-test were 59.93 ± 8.467, and the average value and standard deviation of the post-test in the control class were 81.32 ± 5.863 also increased but the increase was smaller. Thus, the jigsaw cooperative learning model based on ethnoscience is more effective in improving students' understanding of biodiversity material compared to conventional learning methods.

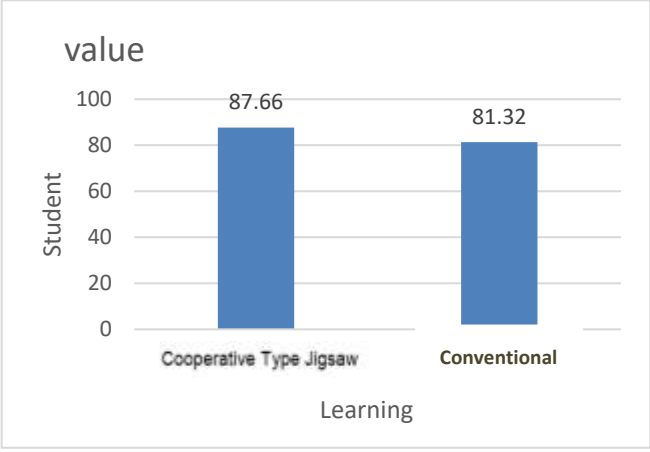

Figure 1. Diagram of Jigsaw and Conventional Cooperative Learning Models on Student Understanding

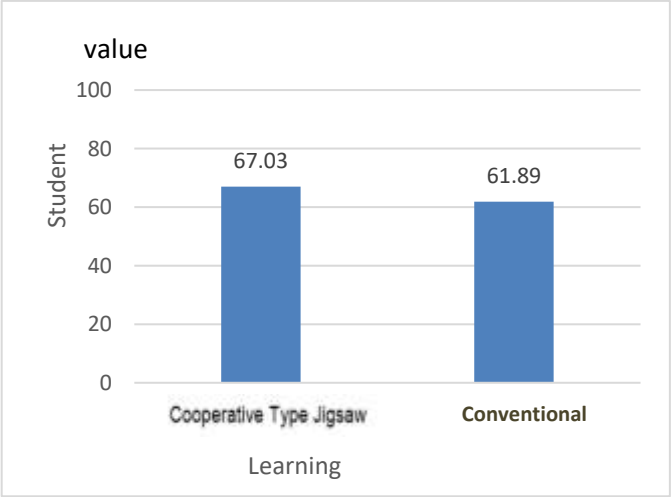

Figure 2. Diagram of Jigsaw and Conventional Cooperative Learning Models on Student Appreciation

Reliability Test

The Cronbach's Alpha Reliability Test , the value is 0.660 with a total of 20 items. This value shows that the instrument has acceptable internal consistency (Meiryani, 2021), although it is not yet fully optimal (> 0.60).

Normality Test

The distribution of pretest and posttest data on students' understanding taught using the jigsaw type cooperative learning model method based on ethnoscience and conventional (can be seen in table 4). From the table 4, overall the pretest and posttest data in the data normality test with both methods (cooperative jigsaw type and conventional) show normal data distribution, with significant values supporting the assumption of normality in the Kolmogorov-Smirnov test (>0.05).

Table 4. Normality Test of Pretest and Posttest Data on Student Understanding

	Kolmogorov-Smi rnov			
Method	**Pretest**		**Posttest**	
	Sig.	Information	Sig.	Description
Jigsaw Type Cooperative	0.189	Normal	0.200	Normal
Conventional	0.149	Normal	0.180	Normal

Homogeneity Test

Based on the results of the homogeneity test, the distribution of pretest data on student understanding was declared homogeneous with a value of (0.960 > 0.05), and the posttest data on student understanding was also declared homogeneous with a value of (0.0770 > 0.05).

Data Analysis

Hypothesis testing was carried out using the Independent sample t-test technique, for the distribution of student understanding data in the experimental class and control class. Independent Samples Test analysis with the help of the SPSS 22.0 application show that the learning method has a very significant effect on student understanding (0.000 < 0.005). and the results of the Paired Sample Test analysis show that there is a significant difference in student appreciation in the post-test and pre-test data (0.00 < 0.05) and pre-test data correlated with post-test data on student appreciation scores (0.01 < 0.05) .

DISCUSSION

The Influence of Jigsaw Cooperative Learning Model on Students' Appreciation and Understanding Based on Ethnoscience

Based on the results of the Independent Samples Test analysis conducted with the SPSS 22.0 application , it shows that the Jigsaw type cooperative learning model has a significant effect on student understanding. This can be seen from the significance value of 0.000, which is smaller than 0.005 (p <0.005). Which means that this learning model has a strong influence on increasing student understanding in the material being taught. The use of an ethnoscience-based approach in learning has also proven effective in helping students understand concepts related to biodiversity, especially in the context of medicinal plants studied by students.

In addition, the results of the Paired Sample Test analysis showed a significant difference between the pre-test and post-test results in terms of student appreciation of the material taught. The significance value obtained was 0.00 (p <0.05), which indicates that after the implementation of the Jigsaw cooperative learning model, there was an increase in student appreciation of the learning material. Which means that ethnoscience -based learning not only improves students' cognitive understanding, but also strengthens their appreciation of the importance of biodiversity and local knowledge.

Meanwhile, the pretest and post-test data also showed a significant positive correlation in students' appreciation scores. The correlation value of 0.01 (p <0.05) indicates that the higher the students' appreciation of the material at the beginning of the pre-test learning, the greater the positive change in appreciation that occurs after the post-test learning. This shows that the Jigsaw cooperative learning model based on ethnoscience not only increases students' appreciation of the material, but also plays a role in deepening their understanding, with significant changes in appreciation along with increased student understanding. This is in line with research conducted by Putri et al., (2022) and Kumalasari & Suyetno (2022) which proves that the application of the Jigsaw type cooperative learning model based on ethnoscience can significantly increase students' understanding and appreciation of biodiversity material, especially in the context of medicinal plants.

jigsaw cooperative learning model is a learning model that involves students actively interacting with subject matter and peers to improve student understanding and be responsible independently (Lubis, 2014). In line with Vygotsky's theory in

research of Etnawati (2022), social interaction is the foundation for cognitive development, and collaborative learning can facilitate students' maximum development zones. The increase in student understanding in this study is in line with this theory, where the Jigsaw model creates interactions that allow students to better understand and build their knowledge through structured discussions.

The application of ethnoscience in the jigsaw cooperative learning model also provides relevance to the local cultural context, with the theory of contextual understanding can improve students' relationships with the material being taught, this ethnoscience-based learning allows students to understand the concept of biodiversity through examples of biodiversity materials, namely medicinal plants that exist around the student's environment and relate them to everyday life, so that it can increase appreciation and understanding of biodiversity learning, especially medicinal plants. This learning model is effective in motivating students to better appreciate local knowledge and culture related to biology lessons, as well as in strengthening their understanding of the scientific concepts being taught.

In line with research Trihartoto & Indarini (2022), Stating that there are differences There are significant differences between the Jigsaw Type Cooperative learning model and the conventional learning model. Which means that the cooperative learning model jigsaw type is more efficient in improving students' understanding and appreciation. In learning with the Jigsaw cooperative model , many students who previously did not know what medicinal plants are and their health benefits, become more actively involved. Activities in this class provide many opportunities for students to actively participate in the learning process, in contrast to conventional classes, where only some students are motivated to play an active role. In conventional classes, interest in understanding the material appears smaller in some students who have higher abilities, while other students tend to participate less because of more limited teacher support, many students still feel confused about the tasks and materials that need to be studied.

Meanwhile, in the Jigsaw model class , students more often ask questions, answer, respond to emerging issues, and seek information about medicinal plants from various learning sources. They also actively participate in focused group discussions, noting important points related to the benefits of medicinal plants. In communicating, they share information and discuss in study groups. Jigsaw type cooperative learning provides space for students to be more involved in the process of seeking and finding solutions to the problems they face. This is different from conventional classes, where learning is often centered on the teacher with the lecture method. In conventional learning, students tend to follow the material given without much opportunity to develop critical thinking in students, because students focus more on listening, taking notes, and memorizing what the teacher says.

The results of the study and statistical testing showed that students who learned through the Jigsaw model showed better improvements in Appreciation and understanding of students' understanding of biodiversity materials, namely medicinal plants based on ethnoscience. This approach has a positive impact by encouraging students to be more active and involved, as well as developing students' Appreciation and understanding, which tend to be less honed in conventional learning.

In line with research conducted by Trihartoto & Indarini (2022), there is a significant difference between the Jigsaw cooperative learning model and the conventional learning model. This shows that the Jigsaw cooperative learning model is more effective in improving students' understanding and appreciation. In learning with the Jigsaw cooperative model, many students who previously did not know what medicinal plants were and their health benefits became more actively involved. Activities in this class provide many opportunities for students to actively participate in the learning process, in contrast to conventional classes, where only some students are motivated to play an active role.

In conventional classes, interest in understanding the material tends to be smaller, especially in students with higher abilities, while other students participate less due to limited support from teachers. Many students still feel confused about the tasks and materials that need to be studied and tend to only focus on delivering information in one direction without providing space for exploration and in-depth discussion (Talk, 2018).

Meanwhile, in classes with the Jigsaw model, students more often ask, answer, respond to issues that arise, and seek information about medicinal plants from various learning sources. They also actively participate in focus group discussions, noting important points related to the benefits of medicinal plants. With individual responsibility in the group, students feel they have a significant role in the success of their group, thus motivating them to be more active in the learning process (Lathifa, 2024). In communication, they share information and discuss in study groups.

The Jigsaw cooperative learning model provides space for students to be more involved in the process of finding and finding solutions to the problems they face. This is different from conventional classes, where learning is often centered on teachers with lecture methods. In conventional learning, students tend to only follow the material given without much opportunity to develop critical thinking, because they focus more on listening, taking notes, and memorizing what the teacher says.

The results of the study and statistical testing showed that students who learned through the Jigsaw model experienced better improvements in terms of appreciation and understanding of biodiversity material, especially ethnoscience-based medicinal plants. This approach has a positive impact by encouraging students to be more active and involved, as well as developing students' appreciation and understanding that tends to be less honed in conventional learning. especially in science subjects that require a strong conceptual understanding (Maslakhatunni, 2019).

CONCLUSION

Based on the results of the study and discussion, the application of the Jigsaw cooperative learning model based on ethnoscience is effective in increasing students' appreciation and understanding of biodiversity, especially in the material of medicinal plants. The study result showed that Independent Sample t-test showed p= 0.000 (<0.005), which means the Jigsaw model based on ethnoscience is more effective than conventional methods. Paired Sample t-test for appreciation showed p= 0.00 (<0.05),

proving an increase in student appreciation. Means that students who learned with the Jigsaw model showed a significant increase in student appreciation and understanding, the involvement of the Jigsaw cooperative learning model not only stimulates cognitive understanding, but also enriches students' appreciation of the importance of biodiversity and relevant local knowledge.

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