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The Influence of Ethnoscience Approach through Problem Based Learning Model on Science Literacy Ability in Buffer Solution Material

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Abstract: The aim of this study was to see the impact of the ethnoscience approach with a problem-based learning model on students' scientific reading skills of buffer solution material in class XI SMA. N 3 Jambi City. The approach used in this study is a quantitative one using a quasi-experimental design with a pre-test design for a first group to test first. The instrument used in this study was an essay test consisting of 9 questions and an assessment tool for student activities as supporting data. The results of the data analysis show that the use of an ethnographic approach with a problem-based learning model has an effect on students' scientific reading skills, as shown by an increase in the average results. average of the test before and after the test, i.e. 51.4% - 76.4%. Based on the obtained data, the result of tcount calculation is 10,4264 and t-table is 2.1098 with actual level = 5%.

Keywords: Buffer solution; Ethnoscience; Problem based learning; scientific literacy

Introduction

The purpose of national education is to give birth to a generation with a concrete and intact national personality, who has the spirit of nationalism and has a sense of pride in the ownership of a national culture as a national identity (Ilham, 2019; Triyanto, 2020;. Learning planning in the curriculum cannot be separated from the values that exist and are held by the community (Andrian & Rusman, 2019). Education is a process of bringing what is learned in school to what is happening in the community (Hashim, 2018; O'Flaherty & Liddy, 2018; Salmon, 2019).

Ethnographic science is a new term emerging in the world of education (Dewy et al., 2019; Khoiri et al., 2019; Suastra & Pujani, 2021). Despite this, learning with an approach to local cultural wisdom is often used by educators as a companion in learning a certain concept (Wati et al. 2021; Nurcahyani et al., 2021). Ethnology is a transition between primitive science and scientific science (Ibe & Nwosu, 2017). The proposed scientific approach to education in Indonesia today is ethnological science, i.e. original knowledge in the form of language, customs and culture, ethics, as well as technology produced by certain persons or persons with scientific knowledge generate (Lightner et al., 2021; Utari et al., 2021). This approach is a strategy to create ethnoscience learning environments and culturally blended learning planning as part of the science learning process (Ebu et al., 2017).

The term ethnology comes from the Greek ethnos meaning "country" and from the Latin scientia meaning "knowledge" (Garfinkel, 2019; Sudarmin et al., 2018). Ethnology more or less deals with the knowledge held by a country or more precisely a certain ethnic or social group (Adhi et al., 2018). Ethnology is also defined as the knowledge to recognize the community's knowledge of the environment (Sapri et al., 2021; Adesoji et al., 2019). Ethnoscience relates to their perceptions, practices, skills and ideas as well as their cosmological basis in the

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context of processing economic developments (Sjoberg, 2017). In everyday life students always interact in the environment and local culture, this can increase the potential for student understanding in learning. One learning model that is able to provide an ethnoscience approach is problem earning.

Problem-based learning is a learning approach that uses real-world problems to teach students critical thinking and problem-solving skills. They also learn theory and concepts from class material or physical subjects (Yew & Goh, 2016; Anafiza & Djukri, 2017). Problem-based learning emphasizes learning as a process involving problem solving and critical thinking in a real-world context (Demirel & Dagyar, 2016). The APP gives students the opportunity to learn broader things, focusing on preparing students to be active and responsible citizens (Ghufron & Ermawati, 2018; Dita et al., 2021) . Through the APP, students gain experience in solving real-world problems and emphasize the use of communication, collaboration, and existing resources to form ideas and develop reasoning skills (Farisi et al., 2017; Gündüz et al., 2016). APP is an alternative learning model that can be applied by educators. Problem-based learning has three goals, which are to help students develop inquiry and problem-solving skills, to provide students with the opportunity to learn from adult experiences and roles, and to help students improve their own capacity (Efendi et al., 2021). One of the skills that can be improved through the problem-based learning model is scientific knowledge.

Scientific knowledge is a person's scientific knowledge and the ability to use this knowledge to identify questions, acquire knowledge, explain scientific phenomena, and describe events (issue) science using scientific evidence (principles and concepts (Rokhmah et al., 2017; Wright et al., 2017; Kluecevsek, 2017). Scientific literacy is a goal that must be achieved by science-centered subjects, one of which is biology. Scientific literacy is important in modern society, because society has many problems related to science and technology (Rubini et al., 2018; Fakhriyah et al., 2017). Scientific literacy generally focuses on four interrelated aspects, namely knowledge, context, competence, and attitudes (Spitzer & Fraser, 2020; Bucchi & Saracino, 2016; Putra et al., 2016). Aspects of knowledge consist of: mastery of basic science material namely physics, life, and technology; knowledge of science which includes an understanding of inquiry and the ability to give scientific explanations (Sutiani, 2021). Scientific literacy supports students to create their own procedures based on the investigations they do. Scientific literacy can also be improved in a subject such as chemistry.

Chemistry is a compulsory subject for students majoring in Mathematics and Natural Sciences, it is hoped that students will be able to follow the learning process well, have more interest in chemistry subjects, and gain useful knowledge, because chemistry subjects are very closely related to everyday life (Grinias et al. al., 2016; Enneking et al., 2019). One of the chemistry materials studied at school is buffer solution material. A buffer solution or also called a buffer solution and also a buffer is a solution which when added a little base, acid, or water does not change the pH significantly (Lee et al., 2017; Mentari et al., 2017). According to Alighiri et al., (2018) The material for buffer solutions contains many abstract concepts and is closely related to everyday life. Learning materials on the subject of buffer solutions include components of buffer solutions, how buffer solutions work, calculation of the pH of buffer solutions, and the function of buffer solutions in living organisms (Qomaliyah et al., 2016; Yerimadesi et al., 2017). Therefore, through the buffer solution material, students are invited to observe the phenomenon of buffer solution in everyday life. In the process of observing, it can train students to be able to see the problem of buffer solutions from different perspectives (Devi et al., 2018; Sanjiwani et al., 2018; Kalikova et al., 2018).

Some research on learning models that can improve students' science literacy skills include:

research conducted by Insani and Insani & Sunarti (2018), using the Social Technological Model (STM), the obtained results show the implementation of the Community Science and Technology learning model in the improve scientific knowledge for students who are placed in the appropriate group with an average score of 3.2. In addition, research conducted by Puspitasari (2015), using a guided inquiry model, can improve students' science comprehension skills, as evidenced by the research results showing that there is a significant differences in improving science literacy among students who attended guided classes. inquiry-based learning. Research by Choerunnisa et al (2017) using the Contextual Teaching (CTL) model is effective in improving students' science reading comprehension skills completely.

According to Sari (2017), analyzed the impact of project-based learning on students' science literacy skills, where their research results showed that project-based learning has an impact better on students' ability to understand science. Research conducted by Haerani et al. (2020) analyzed the free question and answer model on science literacy skills. Research results show that the free question and answer model can improve students' science comprehension skills. Eviani et al. (2018) examine the influence of problem-based learning models on science reading skills of fifth grade elementary students. The results of their study show that the use of problem-based learning models has a very

high effect on students' science skills. In addition, Widiana et al. (2020) analyzed the impact of a problem-based learning model on high school students' ability to understand science on orchestration system hardware. Consistent with Fitriani, Milama and Irwandi (2017) investigated the impact of problem-based learning models on students' science literacy skills on reaction speed literature.

No previous research has analyzed the impact of problem-based learning model combined with ethnoscience approach on students' science reading skills. Using the ethnoscience approach to problem-based learning is an implementation of learning using real-world problems that are closely related to students' daily lives. pupil. In addition, the analysis of problem-based learning models and students' scientific reading skills should be performed on the buffer solution document. Cushioning material is very closely related to our daily life and its applications are often found all around us. Therefore, this study aims to determine the influence of ethnographic science approach through problem-based learning model on scientific reading comprehension skills in the buffer solution document at SMAN 3 Jambi City.

The implication of this study is that an ethnographic science approach can encourage teachers and educational practitioners to teach science based on local culture, wisdom, and existing problems in society. , so that students can understand and apply the science they learn in the classroom that can be used to solve problems.

Method

This research is a mixed method research with one group pretest-posttest research design. Mix method research uses quantitative data and qualitative data (Pluye et al., 2018; Tanti et al., 2021). Quantitative data obtained by giving a pretest (pretest) before being given treatment, after being given it will be given a final test (posttest). This study only used one experimental class that tested twice, namely before being given treatment (pretest) and after being given treatment (posttest). Meanwhile, qualitative data with interviews were carried out to support quantitative data with data in the form of text results. Qualitative data will complement quantitative data with detailed and in-depth explanations (Aldila et al., 2022; Maison et al. 2021; Verma and Chandra 2016).

The data collection tools used in this study include quantitative and qualitative data collection tools. Quantitative data collection tools include student activity scorecards on the application of problem-based learning models and written test sheets to assess students' science literacy skills. While the quantitative data collection tool uses the interview tool. A transcript of the student's activities when applying the problem-based learning model is shown in Table 1.

Table 1. Grid of student activity assessment sheets on the application of the problem-based learning model

Syntax Model Problem based Learning	Aspects of Student Activities	Item
Problem orientation	Students understand the learning objectives conveyed by the teacher.	1
	Students observe the problem of buffer solution presented by the teacher.	2
Organizing students to learn	Students respond to the problems given by the teacher by writing their predictions about what will happen.	3
Help investigate independently	Students read the literature and supporting theory.	4
	Students formulate hypotheses.	5
Organizing students to learn	Students solve problems in LDS.	6
	Students process information, concepts for problem solving.	7
	Students make a report on the LDS based on the results of the discussion and relate it to the relevant theory.	8
Develop and present work	Students present the results of the discussion in front of the class.	9
	Students respond to the opinions of other groups in the form of ideas, alternative ideas to other groups.	10
Analyze and evaluate the results of problem solving	Students convey the conclusions of the learning outcomes.	11
	Students pay attention to reinforcement related to the material that has been delivered.	12

Table 2. Grid of essay test sheets for evaluating students' scientific literacy skills

Basic Competencies	Learning Materials	Item	Question Indicator	Cognitive Realm
Explain the principle of operation, how to calculate pH and the role of buffer solutions for living organisms.	The role of buffer solutions in living organisms and industry.	1	The buffer solution system in the blood.	C4
		2	The buffer solution system in the body.	C4
		3	Buffer solution system in saliva (saliva)	C4
		4	Buffer solution system in food preservation.	C4
		5	Buffer solution systems in agriculture.	C4

Then, the qualitative data collection instrument used in the study is shown in Table 3.

Table 3. Grid of interview instruments

Indicator
Curriculum used
Learning models that have been used
Minimum completeness criteria in chemistry subjects
Model problem-based learning
Students' scientific literacy ability

Population is the entire object observed in the study (Barus & Sani 2017; Charles et al. 2020; Casteel & Bridier 2021). The population of this study included all students of SMAN 3 Jambi City. After that, a research sample was obtained. The sample is part of the population that has the same properties and characteristics so that it can represent the entire population under study (Anderson, Kelley, and Maxwell 2017; Mohammadi et al. 2019; Natsir 2017). The sample for this study was 18 students from Class XII MIPA 2. The population and sample for this study were obtained using certain sampling techniques.

The sampling technique used in this study is purposeful sampling. The purposeful sampling method is the sampling method used by taking into account certain considerations (Aldila et al., 2020; Aldila et al., 2020; Campbell et al., 2020; Etikan et al., 2016) Certain considerations in the purposive sampling technique were carried out to obtain a research sample that was in accordance with the needs of the researcher. This study took an experimental class by paying attention to the characteristics of students.

The data analysis techniques used in this study include quantitative data analysis techniques and qualitative data analysis techniques. Quantitative data analysis techniques include statistics, specifically descriptive statistics and inferential statistics. Descriptive statistics performed by calculating the mean, while inferential statistics were performed using a two-sample t-test. Then, qualitative data analysis was carried out using the Miles and Huberman technique.

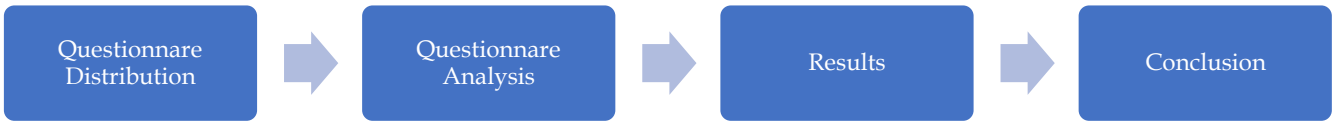

Figure 1. Research flow

Result and Discussion

During the learning process, student activity is observed by three observers. The students were divided into three groups of six people each. The phases of the problem-based learning model are problem-oriented, organizing student learning, supporting independent research, developing and presenting work results, and analyzing and evaluating results. problem solving. The results of the student activity assessment tool using the PBL model are shown in Table 4.

Table 4. Results of Student Activity Assessment Instruments

Meeting	Mean	Category
1	62.38	Good
2	69.56	Good
3	78.70	Good
Mean	70.21	Good

According to the results of assessing students' activities with the ethnographic approach through the APP model, there is an increase in each exposure. If averaged, the average performance rate is 70.21%, so it can be concluded that students' performance in the learning process through a problem-based learning model with ethnic approach Learning goes well and is syntactically correct. To see which syntax influenced the percentage increase in the use of the ethnoscience approach through the student problem-based learning model at each meeting, see the table 5.

Table 5. Average score of PBL implementation syntax

PBL syntax aspect	Meeting			Mean
	I	II	III	
Problem orientation	2.34	3.17	3.47	2.99
Organizing studen learning	2.52	2.78	3.19	2.83

Guiding research	2.81	2.94	3.28	3.01
Presenting work	2.35	2.48	2.76	2.53
Analyze and Evaluate	2.34	2.69	3.22	2.81

Based on the above table. The syntax that has the most influence on increasing the percentage of student activity with the ethnoscience approach through a problem-based learning model is the third syntax. help independent investigation from the average performance score in the third syntax. it's 3.01. For students' scientific reading comprehension skills. they are given several types of questions before and after the test.

Furthermore. a prerequisite test is carried out which includes a normality test and a homogeneity test before performing the t-test.

Table 6. Normality Test

Analyzed data	L_{count}(Lo)	L_{table} (α=0.05)	Information
Student Pretest Results	0.10168	0.200	Lcount < Ltable Data is Normal
Student Posttest Results	0.12508	0.200	Lcount < Ltable Data is Normal

That moment. to calculate the homogeneity test in this study using Fisher's exact method. namely by comparing the largest variance and the smallest variance. The results of running the data uniformity test show that the data is homogeneous because the Fcount value is smaller than Ftable. namely 1.8087 < 2.2719.

After tabulation, the data are normally distributed and have the same variance (homogeneous). such that it meets the requirement of testing the hypothesis by t-test.

Table 7. Hypothesis Test

Data that analyzed	t_{count} t_{table} (α=0.05)		Information
Pretest and Posttest Results Student	10.4264	2.1098	$t_{count} > t_{table}$ Available influence

From the table of hypothesis test results. it can be seen that the price of t_{count} = 10.426. while from the t distribution table. it can be seen that t_{table} = 2.109. Because the value of tcount > ttable. then H0 is rejected and H1 is accepted. In other words. learning in a problem-based learning model that affects students' science reading skills.

This study aims to determine the impact of ethnic science approach through problem-based learning model (PBL) on students' scientific reading skills about buffer solution documents at school. SMAN 3 Jambi City. This study uses experimental class. The study was conducted in three meetings. Before starting an apprenticeship. Students are given a pre-test in the form of an essay test. a total of 3 questions per meeting to see students' science literacy skills. And at the end of the lesson. students are given the following test to see their science reading comprehension skills after the learning process.

In the learning process. The assessment of student performance in an ethnographic approach through a problem-based learning model is observed by one observer in each group. The phases of the problem-based learning model are problem-oriented. organize student learning. help with investigation Independence. develop and present the results of the work. and analyze and evaluate the results of problem solving.

The percentage of student activity at the first meeting only reached 62.38%. However. in this number the student activities are still categorized as good enough even though not all students play an active role in learning. This is also due to less effective learning time where students still feel they need time to adjust to the approach to the applied learning model.

At the next meeting. namely the second and third meetings. there was an increase in the percentage of student activity although it was not so big. namely to 69.56% and 78.7% in both categories. The increasing percentage of student activity for the last meeting can be seen from the student activity assessment instrument that more and more students are taking an active role in learning. Almost all students have good activities during the learning process and follow every step of learning well.

Based on the instrument for assessing student activities at each meeting. the overall average was 70.21%. Where the student activities are categorized as good. So student activities with an ethnoscience approach through the Problem Based Learning model have been going well. and there is an increase in each meeting. This increase in student activity occurs because the better the readiness of students at each meeting. students are accustomed to following the steps of the learning model used.

Based on data from the Science Reading Comprehension Essay Test. The average percentage for the pre-test was 51.4%. while for the latter test the average percentage was 76.4%. From these data. there was an increase in the average percentage from pre-test to post-test. This suggests that using an ethnographic science approach through a problem-based learning model can improve students' science literacy skills. Bringing science and culture closer together can improve student learning outcomes. Research results of Rahayu.

et al. (2006) on the effectiveness of local culture-based learning for better results because learning occurs in a way that is more meaningful to students. At the first meeting. the percentage of students achieving scientific knowledge before the test is 47.22% and after the test is 66.67%. This can happen because students are not ready to follow the lesson well. At the second meeting. ratio of scientific culture of students skills at the pretest was 46.75% and at the posttest there was an increase to 73.14%. The increase in the percentage of students' scientific literacy skills is because students have started to be able to follow the lesson well. At the third meeting. the percentage of students' scientific literacy skills at the pretest was 59.26% and at the posttest it increased to 87.96%. This is because students already understand how to identify the results of each variation of learning and are able to observe any changes that occur. And according to the results of research conducted by John Dewey (in Hosnan. 2014) concluded that students will learn well if what they learn relates to what they already know and to the activities or events going on around them.

The average student's pre-test percentage result was 51.4% and the average student's post-test percentage result was 76.4%. There was an increase in the students' pre-test GPA after the test. this is due to the positive influence of the learning that takes place at each meeting. According to Pertiwi (2019). Culture-based learning provides students with the opportunity to identify scientific questions. explain scientific phenomena and draw conclusions about natural conditions through human activity. This is consistent with the 2006 PISA statement that prescribes three aspects of competencies or processes to improve students' scientific knowledge with an ethnoscience approach.

Based on the results of hypothesis testing by t-test. tcount value is 10,42623 and ttable value is 2.1098. This proves that H0 is rejected and Ha is accepted. that is, there is the influence of the ethnographic approach of the problem-based learning model on the students' reading comprehension skills of the buffer solution in a scientific way.

The effect that will be observed is the use of an ethnographic approach through the PBL model with the student's ability to understand science, which will then be expressed in terms of student learning outcomes. The test was performed using a paired sample t-test, with the data used being the students' pre-test and post-test data normally distributed. Or before being tested with the sample pair t-test. The data is first checked for normality to see if the data is normal as a condition of the parameter test. To see if the obtained data is normally distributed. The researcher used the Liliefors test and the results obtained in the pre-test L panel were 0.10168 and the Lcount was 0.2. Because Lcount < Painting. The data is normally distributed. And for post-test data. the result of Ltable is 0.12508 and Lcount is 0.2. Because Lcount < Painting. The data is normally distributed. After the data obtained is normally distributed. Homogeneity tests were performed on the data using Fisher's test. The result of Fcount is 1.8087 and Ftable is 2.2719. Because Fcount < table. data is consistent. After the data obtained is normally distributed. a paired t-samples trial was performed to see the difference before and after treatment. Test data t-test sample pairs and calculations.

Based on the obtained data. calculation result is tcount 10,4264 and ttable 2.1098. So Ho was rejected. that is, there is a difference in students' science understanding skills before and after learning according to the ethnic science approach through the PBL learning model. Therefore, the use of ethnographic approach through the APP model has an effect on students' scientific reading comprehension skills. The minimum complete criteria were obtained from interviews with teachers of applied chemistry in schools. namely 70. According to the calculations. Student's score is taken up to 12 students with scores above Minimum Completeness Criteria and 4 students who did not complete or were below Minimum Completeness Criteria. Approximately 77.8% of the total students achieved proficiency in student reading comprehension tests using the written test. It can be said that there is a difference in the science comprehension skills of students using the ethnographic approach through the PBL learning model on the buffer solution document for Class XI MIPA 2SMAN 3 Jambi City. This means that the ethnographic science approach through the PBL learning model has an effect on students' critical thinking ability, which is reflected in the increase in science literacy skills. student learning before and after treatment.

This PBL model provides opportunities for students to gain more experience because it emphasizes solving realistic problems when students communicate formulate/deliver ideas so that they can develop their reasoning skills and have a sense of responsibility and work together (Nafiah, 2014). The integration of the ethnoscience-based PBL model can improve learning outcomes. this cannot be separated.

Contextually. the teacher in the learning process provides real examples that exist in the surrounding environment by linking elements of cultural perspectives and organized local wisdom so that they train and develop thinking and literacy skills. especially chemical literacy. Chemical literacy skills are basically built by accustoming students to be able to think independently to build knowledge concepts (Anggraeni & Wardani. 2020) while also understanding things

according to procedures (epistemic knowledge). so they can apply these concepts in their lives (Rahayu. 2017).

In studying the concept of buffer solution material. students are involved in thinking that is related to the cultural context of Jambi City. such as the performance of the buffer solution in saliva in maintaining oral pH in the phenomenon of chewing betel leaves carried out by parents and traditional stakeholders at weddings and celebrations. analyze how preservatives can keep food durable. for example in pineapple dodol products. Through this real concept. students become more motivated. interested in learning and more importantly. students know the habits of the local community.

The application of this ethnoscience-based PBL learning model utilizes the local environment and culture as a learning resource by applying problem-solving learning patterns that provide space for students themselves as active learning subjects (student centered) to be able to think more creatively. critically. logically and independently (Amalia et al. al.. 2020). This scheme can indirectly affect students' motivation to develop their generic science skills. The increase in student activity in each meeting is also getting better. this can be seen from the readiness of students at each meeting and students try to get used to following the steps of the learning model used. Through a problem-based learning model. students learn how to respect nature and master science by utilizing technology (Arifatun et al.. 2015). This makes learning meaningful and has value because learning is linked in everyday life and participates in preserving local culture so that it is not eroded by the increasingly free flow of modernization.

Conclusion

Based on the results of the research can be concluded that student activities with ethnographic approach through problem-based learning model went well and increased with each meeting. And there is a significant influence of the ethnographic approach through the problem-based learning model on the accompaniment of students' science reading skills. The theoretical significance of the results of this study indicates that the application of the PBL model with an ethnographic approach has an effect on the ability to understand the chemistry of buffer materials. For this reason. Similar research should be carried out for other chemical materials, and research can be conducted to develop relevant ethnographic-based teaching materials to capture student interest. born. motivated and cultured.

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Aulia Sanova, Create articles and correspondence from articles. Affan Malik, Creating and validating instruments, Yuniarccih, Data collection and data management.

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