JPPIPA 8(6) (2022)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Effects of Learning with Ethnoscience Context on Learning Outcomes in Cognitive Aspects of Prospective Physics Teacher Students

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Received: November 6, 2022
Revised: December 19, 2022
Accepted: December 24, 2022
Published: December 31, 2022

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DOI: 10.29303/jppipa.v8i6.2388

Abstract: Student learning outcomes in the cognitive aspect need attention because it is the professional competence of prospective teachers related to mastery of learning materials. The purpose of this study was to analyze the effects of learning in the context of ethnoscience on learning outcomes in the cognitive aspects of prospective physics teacher students. The research method used is quantitative with two stages. First, a limited trial study with a one-group pretest-posttest design at Hamzanwadi University with a total of 9 students. Second, experimental research with a post-test only group design was conducted at the University of Mataram, with a total of 77 students. In a limited trial study, an N-gain test analysis was carried out to determine the success rate of treatment with the minimum category being in the "medium" criteria. In experimental research, the effect of treatment was tested. The research sample includes all students who take the High School Physics Studies course at the Physics Education Study Program, University of Mataram, in the 2021/2022 Academic Year. The class is divided into 3 groups consisting of a class that uses an LMS with an ethnoscience context (Group A) totaling 27 people, a class using an LMS with a module (Group B) totaling 23 people, and a class using an LMS with PowerPoint (Group C) totaling 27 people. Cognitive learning outcomes data were obtained from giving essay tests after treatment. Analysis of the data used to test the hypothesis is a one-way ANOVA with SPSS 25 calculation. The results show that the average value of Group A is 78.00, Group B is 70.70, and Group C is 70.96. Lectures in Group A have a significant influence on student cognitive learning outcomes. The conclusion of this study is that learning in the context of ethnoscience has a positive effect on the professional competence of prospective physics teachers.

Keywords: Ethnoscience; Learning outcomes; Cognitive aspects.

Introduction

At the beginning of the COVID-19 pandemic, people still didn't really care about various government calls to prevent the transmission of the virus (Putra & Abidin, 2020). The COVID-19 pandemic is expected to end in April 2021 if the public obeys the government's advice (Zuhairoh & Rosadi, 2020), including the lock down policy (Razon, 2020). However, until 2022, the pandemic is still ongoing due to various factors. The COVID-19 pandemic has had a major impact on all life activities, including activities in the field of education (Machmud & Minghat, 2020). The pandemic has led to social and physical distancing which requires face-to-face learning to switch to online learning (Ana, 2020).

The use of LMS as an alternative to online learning can increase the satisfaction and quality of learning. Learning through LMS can reduce various weaknesses of traditional learning such as teaching materials delivered by lecturers cannot be repeated, lecturer explanations and small notes are also still limited. Online learning through LMS overcomes the limitations of space and time because it can be accessed anywhere and anytime. The development of an all-digital era today also requires lecturers and students to use IT technology,

How to Cite:
Hikmawati, H., Sutrio, S., Wahyudi, W., & Syahidi, K. (2022). Effects of Learning with Ethnoscience Context on Learning Outcomes in Cognitive Aspects of Prospective Physics Teacher Students. *Jurnal Penelitian Pendidikan IPA*, *8*(6), 2793–2801. https://doi.org/10.29303/jppipa.v8i6.2388

learning materials can be stored and shared via the internet (Rabiman et al., 2020).

Online learning through the Learning Management System (LMS) has been proven to increase student learning activities. One of the popular LMS applications with various features that can be used in learning is Moodle, which is also widely used in universities. Various features in a moodle-based LMS are attendance lists, learning materials, discussion forums, chats, and quizzes for evaluation (Simanullang & Rajagukguk, 2020). Online lectures through LMS can provide significant services for individual students and groups (Duin & Tham, 2020). Online learning through LMS is easy to implement, practical, and effective in improving student learning outcomes (Saputro & Susilowati, 2019).

Online learning is influenced by the availability of facilities, the ability of teachers and students to use these facilities, and how the process of online learning activities takes place (Mulyanti et al., 2020). Online learning must be designed in such a way that it can attract students' interest in learning (Rasim et al., 2021). The learning process must facilitate all aspects of learning outcomes so that student achievement is high. Aspects of learning outcomes in question are aspects of knowledge, attitudes, skills, and habits. All these aspects need attention from the teacher, not only in face-to-face learning, but also in on-line learning (Hashim et al., 2021).

Research on the impact of COVID-19 on acceptance of e-learning, including LMS, needs to continue during the pandemic. This can develop various online learning innovations that will have a good impact in the future, especially due to the development of an all-digital era (Raza et al., 2021). One of the developments of the online lecture model is lectures with an ethnoscience context.

Learning in the context of ethnoscience in the form of local genius can improve student learning outcomes, especially the generic skills needed by prospective teachers so that they can become professional teachers in the future (Dewi et al., 2021). Various local wisdoms, including ethnoscience, can be used as learning resources in developing learning programs in the field of education, especially science learning (biology, physics, chemistry). For example, the Sasak people living around Mount Rinjani have and develop indigenous knowledge and technology systems as local wisdom in dealing with nature and the surrounding environment. Local wisdom, including ethnoscience, is sourced from religious values, customs, and local culture, as well as ancestral or ancestral traditions (Utami & Efendi, 2018).

Various traditions or customs, including traditional clothing, are also included in ethnoscience which can be integrated in learning. For example, "Lambung" which is the traditional clothing of the Sasak tribe. "Lambung" is used in several traditional ceremonies, weddings, or welcoming guests. In addition to the value of science that can be integrated into learning, the traditional "Lambung" clothing also has various character values, social and cultural values that need to be preserved, especially in the midst of local culture which has begun to be eroded by the times (Burhanudin et al., 2022).

Ethnoscience derived from traditional medical traditions such as "Sembeq" in the Sasak tribe, Lombok can also be integrated in learning. The main ingredients of this traditional medicine include betel leaf, areca nut, and fine lime. Content in science includes the concept of mixtures, chemical reactions, bases, Power of Hydrogen or solution pH, secondary metabolites, and surface area (Andayani et al., 2021).

Learning with an ethnoscience context can not only be applied in primary and secondary schools, but also at the university level (Utami et al., 2019). Learning with ethnoscience contexts can be applied through a student-centered approach, namely through various innovative learning models such as discovery learning, problem-based learning, and project-based learning (Wahyu, 2017). Learning with ethnoscience contexts can also be combined with STEM-based learning (Nurhayati et al., 2021). Learning with an ethnoscience context needs to be developed to assist teachers in building student character. Students will also be more familiar with the surrounding culture so that it instills the concept that the learning is close to students' daily lives (Andayani et al., 2021).

Learning in the context of ethnoscience not only plays a role in improving cognitive learning outcomes, but also character values and conservation behavior (Utari et al., 2021). Learning with an ethnoscience context can also foster entrepreneurial interest in students (Khoerunnisa et al., 2016) and an attitude of cultural care (Hikmawati et al., 2020). This study aims to analyze the effects of learning in the context of ethnoscience on learning outcomes in the cognitive aspects of prospective physics teacher students.

Method

This research is quantitative research which is divided into two stages. First, a limited trial study using a one-group pretest-posttest design. Second, experimental research uses a post-test only group design. The stages are described in detail below. Prior to the treatment at the University of Mataram, a limited trial of online lectures with ethnoscience was conducted at Hamzanwadi University. The number of students who took part in the limited trial at the Physics Education Study Program, Hamzanwadi University was 9 people. Students were given an essay test before and after treatment to measure the data on cognitive learning outcomes. After the treatment in a limited trial was declared successful in improving student learning

outcomes in the cognitive aspect, experimental research was carried out at the Physics Education Study Program, University of Mataram. The success of treatment in a limited trial was analyzed through the N-gain test with the minimum criteria being in the "Medium" category. The increase in score is calculated using N-gain through the following equation 1 (Hake, 1999):

$$N - gain = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} x100\% \quad (1)$$

The category of N-gain gain is shown in Table 1.

Table 1. Category of N-gain

Interval (%)	Category
g > 70	High
30 ≤ g ≤ 70	Medium
g < 30	Low

The treatment in experimental research is a lecture using the Learning Management System (LMS) at SPADA UNRAM (University of Mataram Online Learning System). The research sample consisted of 77 students who attended lectures: High School Physics Studies at the Physics Education Study Program, University of Mataram, in the 2021/2022 Academic Year. The class in this study was divided into three groups, namely the class that used the LMS with an ethnoscience context (Group A) which amounted to 27 people, the class that used the LMS with the module (Group B) which amounted to 23 people, and the class that used the LMS with PowerPoint (Group B). C) totaling 27 students.

Cognitive learning outcomes data were obtained from giving essay tests after treatment. Analysis of the data used to test the hypothesis is one-way ANOVA with calculations through the SPSS 25 application. The steps taken are data normality tests using Shapiro-Wilk, data homogeneity tests using Levene, ANOVA, Post Hoc tests (multiple comparisons), and analysis for Homogeneous Subsets.

Normality test and homogeneity test are requirements to perform ANOVA test. Normality test was conducted to find out the data for each group was normally distributed. Homogeneity test was conducted to determine the variance between groups should be homogeneous. The basis for making decisions for the normality test and homogeneity test is as follows.

The basis for making normality test decisions is if the significance value is greater than 0.05, then the data is normally distributed, whereas if the significance value is less than 0.05 then the data is not normally distributed. The basis for making the decision on the homogeneity test is if the significance value is greater than 0.05, then the data is homogeneous, while if the significance value is less than 0.05, the data is not homogeneous. The basis for decision making in ANOVA is: if the significance value is greater than 0.05 then the average cognitive value is the same for all groups or classes, whereas if the significance value is less than 0.05 then the average value is different.

Post-Hoc Tests in this study aim to find out which group has the same and different cognitive average scores. The type of test used is the Tukey HSD, namely: Multiple Comparison testing to determine whether the average cognitive value is significant in the amount of analysis of variance. To test whether there is a difference in average cognitive scores between Group A (classes that use LMS with an ethnoscience context), Group B (classes that use LMS with modules), and Group C (classes that use LMS with PowerPoint) can be seen from the significance value. SPSS output results, the value is greater or less than 0.05.

Result and Discussion

Student learning outcomes on cognitive aspects during limited trials at Hamzanwadi University showed a pre-test score of 66 and post-test of 82. The N-gain calculation showed an increase in student cognitive learning outcomes scores of 45 which were in the "medium" criteria. Therefore, online lectures with an ethnoscience context can be said to have succeeded in improving student learning outcomes in the cognitive aspect. This is shown by Figure 1.

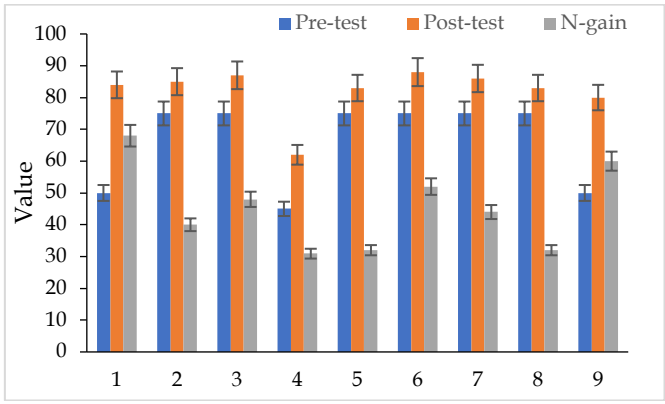

Figure 1. Cognitive value during the trial was limited

The results of experimental research at the University of Mataram showed that the average value of student learning outcomes in the highest cognitive aspect was owned by Group A, namely the class that used LMS with an ethnoscience context of 78.00, followed by Group C, namely the class that used LMS with PowerPoint of 70.96, and the last is Group B, which is a class that uses LMS with a module of 70.70. This is shown in Table 2.

Table 2. Descriptive Data

Group	N	Mean	Std. Deviation	Std. Error
LMS with ethnoscience	27	78.00	5.657	1.089
LMS with Module	23	70.70	6.567	1.369
LMS with PowerPoint	27	70.96	7.314	1.408
Total	77	73.35	7.319	0.834

The first step as a condition for the one-way ANOVA test is the normality test, which in this case uses the Shapiro-Wilk test. SPSS output shows that the significance value for all groups (LMS with ethnoscience, LMS with Module, and LMS with PowerPoint) is greater than the alpha significance value of 0.05. Therefore, it can be stated that the data is normally distributed. In other words, the first condition in the ANOVA test has been fulfilled. The output data for the normality test is shown in Table 3.

Table 3. Normality Test

Group		Shapiro-Wilk		
		Statistic	df	Sig.
Cognitive	LMS with ethnoscience	0.959	27	0.350
	LMS with Module	0.951	23	0.311
	LMS with PowerPoint	0.955	27	0.289

The second step as a condition for the one-way ANOVA test is the homogeneity test. The variance similarity test used was Levene, with SPSS output showing a significance value of 0.241 which is greater than the alpha significance value of 0.05. The conclusion is that the variants of the three groups (LMS with ethnoscience, LMS with Module, and LMS with PowerPoint) are the same or homogeneous. That is, the assumption of homogeneity in the one-way ANOVA test is met. The output data for the homogeneity test is shown in Table 4.

Table 4. Homogeneity Test

		Levene Statistic	df1	df2	Sig.
Cognitive	Based on Mean	1.451	2	74	0.241
	Based on Median	1.157	2	74	0.320
	Based on Median and with adjusted df	1.157	2	72.876	0.320
	Based on trimmed mean	1.509	2	74	0.228

The data is normally distributed and the variance of the three groups is homogeneous, so the next step is a one-way ANOVA test. The one-way ANOVA test in this study serves to test whether the three research samples have an average value of student learning outcomes on the same cognitive aspect or different. From the SPSS output, information is obtained that the significance value of 0.000 is smaller than the alpha significance value of 0.05. Thus, it can be concluded that the average value of student learning outcomes on cognitive aspects for the three groups (LMS with ethnoscience, LMS with Module, and LMS with PowerPoint) is significantly different. ANOVA output data are shown in Table 5.

Table 5. ANOVA

Cognitive	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	899.700	2	449.850	10.495	0.000
Within Groups	3171.833	74	42.863		
Total	4071.532	76			

The next step is to analyze the Post Hoc Tests output. In the Multiple Comparison output section, information is obtained that the value of student learning outcomes in the cognitive aspect for the LMS with ethnoscience group and the LMS with Module group has a significance value of 0.001 which is smaller than the alpha significance value of 0.05. This means that: the mean scores of the two groups are "different", so that the descriptive mean difference in cognitive scores between the two groups is "significant". Likewise for the LMS with ethnoscience group and the LMS with PowerPoint group, it turned out that the descriptive average difference in cognitive scores between the two groups was "different", so the difference in descriptive cognitive average scores between the two groups was "significant".

The students' cognitive average value for the LMS with Module group and the LMS with PowerPoint group has a significance value of 0.989, which is greater than the alpha significance value of 0.05. This means that: the average value of the LMS with Module group and the LMS with PowerPoint group is "the same", so the difference in descriptive cognitive average scores between the two classes is "not significant". Multiple Comparison data can be seen in Table 6.

Furthermore, the average similarity of cognitive scores in the three groups (LMS with ethnoscience, LMS with Module, and LMS with PowerPoint) can be seen through the output of Tukey HSD, namely in the output section of Homogeneous Subsets. In subset 1 there is data on cognitive scores in the LMS with Module and LMS with PowerPoint groups, which means that the average cognitive scores of students in the two groups do not have a significant difference. In other words, the

average cognitive scores of students in the LMS with Module and LMS with PowerPoint groups were the same. In subset 2 there is only data on the cognitive scores of students in the LMS with ethnoscience group, which means that the scores of students in this group have a significant difference with the other two groups (LMS with Module and LMS with PowerPoint). Thus, it can be said that learning in the LMS with ethnoscience group has a significant effect on differences in students' cognitive scores. The learning referred to in this study is online lectures through LMS with the context of ethnoscience in the subject: High School Physics Studies. The output data for Homogeneous Subsets can be seen in Table 7.

Table 6. Multiple Comparison

Dependent Variable:	Cognitive	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD				
(I) Group				
LMS with ethnoscience	LMS with Module	7.304*	1.858	0.001
	LMS with PowerPoint	7.037*	1.782	0.001
LMS with Module	LMS with ethnoscience	-7.304*	1.858	0.001
	LMS with PowerPoint	-0.267	1.858	0.989
LMS with PowerPoint	LMS with ethnoscience	-7.037*	1.782	0.001
	LMS with Module	0.267	1.858	0.989

*. The mean difference is significant at the 0.05 level.

Table 7. Homogeneous Subsets

Cognitive Tukey HSD[a,b]	N	Subset for alpha = 0.05	
Group		1	2
LMS with Module	23	70.70	
LMS with PowerPoint	27	70.96	
LMS with ethnoscience	27		78.00
Sig.		0.988	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 25.521.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Online learning systems that use LMS rely heavily on information and communication technology infrastructure, as well as computer technology for the use of the LMS system (Aldiab et al., 2019). Online learning through LMS can overcome the limitations of the number and time of meetings. Lecturer and student interactions, as well as student-student interactions are increased through learning using LMS (Muhardi et al., 2020). Student learning outcomes using LMS increased in the high category and student responses to LMS were very good (Zai et al., 2020). The use of technology in learning can be accepted by students. Student responses to online learning, such as LMS, are in the good category so that the use of IT in learning needs to be continuously developed (Anugrahana, 2021).

Utilization of online learning during the COVID-19 pandemic supports student-centered learning activities. Online learning has succeeded in improving student learning outcomes which can be seen from the increase in scores on pre-test and post-test. The online learning trains students to become independent learners so that they can think critically as a provision to compete in the future (Sangsawang, 2020).

Lecturers must be able to take advantage of online learning in the era of web 5.0 technology and produce IT-based learning innovations in order to develop student electronic activities. It is intended that the online learning process can be effective in improving student learning outcomes according to the learning objectives that have been set. Thus, the goals of national education can also be achieved as expected (Saripudin et al., 2020). Lecturers can provide more examples or practice questions and facilitate the learning process well so that students can have both declarative and procedural knowledge as expected (Jupri & Sispiyati, 2020).

Students use IT and internet technology to support their efforts in understanding the material and completing various assignments. Students use information media such as social media and television broadcasts as material to find information about learning materials or discussion topics in online learning. They will verify the information they have obtained with their family and friends (Hashim et al., 2020). Therefore, in an online learning system that utilizes IT, lecturers are required to be innovative in developing learning tools, such as teaching materials in the form of modules, as well as PowerPoint media. This plays a role in helping students learn independently at home.

Teaching materials including ethnoscience-based modules, such as the integration of salt-making traditions, can link students' original scientific knowledge with scientific knowledge. The integration of ethnoscience in learning will have a good impact on student learning outcomes and will create meaningful learning for students. This is because ethnoscience is a phenomenon that is seen and experienced by students in the environment where they live (Utari et al., 2020). Therefore, learning with the context of ethnoscience is a contextual learning that needs to be continuously developed. Learning in the context of ethnoscience is full of local wisdom values that affect the development of student character values.

Learning in the context of ethnoscience can be done through observation activities, learning resources from the environment, or through interviews and surveys and article analysis. Assessment in learning in the context of ethnoscience can be done authentically, just like

conventional learning (Puspita Hadi et al., 2020). Excavation of character values through the values of local wisdom in learning in the context of ethnoscience can be used as a capital for the comparative and competitive advantage of a nation. Learning in the context of ethnoscience is one of the efforts to create harmony between humans and humans, humans and nature, and humans and God (Wagiran, 2012).

Learning tools with an ethnoscience context that are implemented through online learning or LMS can also be integrated in the form of teaching materials such as e-modules and PowerPoint media. Learning tools made in the form of e-learning or LMS are effective in improving learning outcomes. E-learning tools are not only limited to learning materials about circular motion, but can also be developed in other physics learning materials (Wati et al., 2022). Utilization of LMS in effective learning to improve student learning outcomes in physics subjects, namely in the material of Simple Harmonic Motion (Wati et al., 2021).

E-learning-based modules are interactive media that deserve to be developed in the current digital era so that students are not left behind in terms of skills in using technology (Yetti & Ahyanuardi, 2020). Physics learning module based on cognitive conflict approach can be an alternative learning media that will facilitate students to understand the concept being studied (Faresta et al., 2020). The application of e-modules can increase students' interest in learning so that cognitive learning outcomes also increase (Rusli & Antonius, 2019). The implementation of contextual-based modules can improve students' cognitive learning outcomes. The module developed is for physics material which discusses the concept of Work and Energy (Ibrahim & Yusuf, 2019). There are significant differences in cognitive learning outcomes between classes that use e-modules and conventional classes in the science learning process (Mutmainah et al., 2021).

As mentioned above, learning tools in the online learning system through LMS can not only be assisted by e-modules, but also in the form of PowerPoint. Teachers can deliver material in a structured way through PowerPoint presentations so as to help students understand the learning material well (Primaningtyas et al., 2021). PowerPoint-assisted online learning can improve student learning outcomes (Rizal et al., 2021). Online learning by utilizing PowerPoint media not only improves learning outcomes, but also increases student activity during the learning process. (Suparmiasih, 2021).

Conclusion

The average score of students on cognitive aspects for the LMS group with ethnoscience context has a significant difference with the other two groups, namely the LMS with Module group and the LMS with PowerPoint group. Online lectures in the LMS group with ethnoscience contexts have a significant effect on differences in students' cognitive scores in the High School Physics Studies course. Lectures with an ethnoscience context can be said to have a positive effect on the professional competence of prospective physics teachers.

Online lectures with an ethnoscience context can be an alternative model for lectures during the COVID-19 pandemic which requires restrictions on face-to-face interactions in class. Lectures with an ethnoscience context can facilitate the creation of meaningful learning for students. The integration of ethnoscience in learning is contextual learning, because ethnoscience is something that is seen and experienced by students in the environment where they live.

Acknowledgements

The author would like to thank the Dean of the Faculty of Teacher Training and Education, University of Mataram and the Dean of the Faculty of Mathematics and Natural Sciences, Hamzanwadi University and their staff so that this research can be completed properly.

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