Tekno-Pedagogi 15 (1) (2025)
ISSN: 2088-205X | E-ISSN: 2715-7415
Tekno-Pedagogi : Jurnal Teknologi Pendidikan
https://online-journal.unja.ac.id/pedagogi
DOI: 10.22437/teknopedagogi.v15i1.42200

Implementation of Module Based on Predict-Observe-Explain (POE) Integrated with Ethnoscience: Analysis of Relationship with Students' Concept Understanding

Selina Damayanti[1,*], Boby Syefrinando[1], Fibrika Rahmat Basuki[1], Sereima Baleisomi Takiveikata[2], Saprolla Rollie C. Deporos[3]
[1]Universitas Islam Negeri Sultan Thaha Saifuddin Jambi, Jambi, Indonesia
[2]Fiji National University, Suva, Fiji
[3]Ateneo de Davao University, Davao, Philippines
Corresponding author email: selina.damayanti.eyi31@gmail.com

Info Article
Received: 11 Nov 2024
Revised: 05 Jan 2025
Accepted: 26 Feb 2025
Online Version: 05 Mar 2025

Abstract
This study aims to test the effectiveness of the Predict-Observe-Explain (POE)-based Physics module integrated with ethnoscience in improving students' conceptual understanding of static fluid material. This study used a quasi-experimental method with a one-group pretest-posttest design, involving 70 grade XI students at State Senior High School 8, Jambi City. Data were collected through pretests, posttests, and student response questionnaires. The t-test results showed a significant increase in student learning outcomes, where the average pre-test score of 65.4 increased to 85.7 after learning ($p < 0.05$). The Pearson correlation test showed a significant positive relationship between student responses to the module and conceptual understanding ($r = 0.762$, $p < 0.05$). These findings indicate that the POE-based module integrated with ethnoscience can improve students' conceptual understanding by linking scientific concepts with local wisdom. This study contributes to developing innovative teaching materials that are contextual and empirically evidence-based. Further research is recommended to expand the application of the module to other subjects and larger populations.

Keywords: Ethnoscience, Modules, Predict-Observe-Explain (POE), Static Fluids

INTRODUCTION

Physics is a major branch of Natural Sciences that focuses on understanding natural phenomena and the consequences of human activities through a scientific approach (Chen & Srimadona, 2023; Socrates et al., 2023). As part of the school curriculum, physics aims to introduce knowledge about the universe and train thinking and reasoning skills (Holmes et al., 2021; Palmgren & Rasa, 2024). In addition, physics also functions to hone students' analytical thinking skills through observations of various natural phenomena (Pols, 2021; Derex, 2022). As a science that is directly related to various natural events and phenomena, physics is an important field to study, understand, and evaluate (Klein et al., 2021; Yusra et al., 2023). Even though it is vital, the majority of students fail to study physics because the subject matter

is complex, especially remembering formulas and abstract concepts (Bouchée et al., 2022; Karuku, 2023). This state affects the achievement of students' learning outcomes that remain below par. Physics learning is often considered difficult by students because of its abstract concepts and lack of relevance to everyday life (Hendriyani, 2023; Herlanti et al., 2025). Based on observations at SMA Negeri 8 Jambi City, many students have difficulty understanding static fluid material, especially in the aspects of Pascal's law and Archimedes' principle. The learning method used is still dominated by lectures with the main media being textbooks and blackboards, so that student involvement in the learning process is still low (Amelia et al., 2021; Supriyadi et al., 2022). Furthermore, experiments are hardly ever conducted due to inadequate laboratory facilities which are not accessible for supporting direct practice. The state causes student learning outcomes still lacking the Minimum Completion Criteria (KKM), thereby there is an urgent requirement for learning innovation.

Several previous studies have shown that the Predict-Observe-Explain (POE) learning model is effective in improving students' conceptual understanding (Umi & Siswanto, 2022; Gyeltshen & Wangchuk, 2025). However, research on the integration of POE with ethnoscience in Physics learning is still limited, especially in the context of static fluids. The ethnoscience approach allows students to understand Physics concepts by linking them to local culture and wisdom, so that learning becomes more meaningful (Perrotta et al., 2017; Normalita et al., 2023; Jana et al., 2024). The literature review shows that POE and ethnoscience-based modules have the potential to increase student motivation and engagement in learning. Therefore, this study implements a POE-based module integrated with ethnoscience that has been developed previously to fill the gap in previous research.

The relevance of this study is the call for Physics learning innovation to be more contextual and interactive in terms of timeliness. The modules already designed have been found to be very feasible by experts and very acceptable to teachers and students. However, the implementation of the modules in the classroom has not yet been done, and therefore the effectiveness of the module in improving the learning outcomes of the students has not yet been empirically proven. It is difficult to determine how much the module can assist students in understanding static fluids without it being implemented. This study therefore intends to confirm the effectiveness of the module in real learning situations. The novelty of this study lies in the merging of the POE model with an ethnoscience approach, which has seldom been applied to Physics learning. The integration of local wisdom in the learning of Physics will be likely to make the subject more applicable to the day-to-day lives of students and strengthen their scientific learning (Arsal et al., 2023; Nurdauletova et al., 2024; Haryono et al., 2025). Besides that, this study uses a quantitative approach using correlation tests and t-tests using SPSS to analyze the correlation between module usage and students' conceptual understanding (Nabila & Dev, 2024; Yulianti & Awingan, 2024). This study not only tests the efficacy of the module but also analyzes the extent to which the module can influence students' understanding. This approach provides an additional contribution towards the development of more contextual and empirically based learning strategies (Jamaluddin et al., 2022; Gill et al., 2025; Ikram et al., 2025).

This study is a method of dissemination of the results of module development that has already been performed. The module developed using the ADDIE model has passed cycles of expert checking and feasibility tests by the students and the teachers. Nevertheless, without implementation in the classroom, it cannot be said that this module is successful in improving the understanding of students. Therefore, this study aims to implement the module into real learning and evaluate its impact on student learning outcomes. This study is expected to provide implications for teachers in using POE-based modules combined with ethnoscience in the classroom. The main objective of this study is to assess if POE-based Physics module coupled with ethnoscience would work well for results in student learning. In addition to this, the current study also seeks to analyze the correlation between the application of the module and how deeply students master the topic of static fluids. This research will evaluate whether the use of the t-test is applicable to see if there is a difference between learning outcomes prior to and subsequent to using the module. The correlation test will be applied to view the relationship between student response towards the module and level of conceptual understanding (Budiarti et al., 2024; Yustitia et al., 2025). Through this approach, the study is able to provide more detailed facts regarding how the

module influences learning.

This research will be beneficial for the creation of new learning materials in studying Physics. Through using modules as a teaching tool in classrooms, educators can understand how the POE and ethnoscience frameworks can improve students' learning outcome and enthusiasm (Muangasame & Tan, 2023; Baharuddin et al., 2024). The results of this research can also be the basis for developing the same modules in other courses that must be tackled contextually (Mutmainnah et al. 2023; Ngao & Sang, 2024; Afrilyasanti et al., 2025). This research is also expected to make educational policies more and more conducive to the implementation of innovative modules in the learning process (Anggraeni et al., 2023; Haryanto et al., 2024). Thus, this study can be the start of improving the quality of Physics learning in Indonesia.

RESEARCH METHODS

Quantitative research utilizing a quasi-experiment approach is used in the study. The approach is applied to test the effectiveness of the module designed to improve students' learning achievement and mastery of concepts. The quasi-experiment approach was used due to the conditions of the study that did not allow random allocation of subjects, thus, the study was conducted on available groups. This study highlights statistical calculation of the learning outcomes of students before and after using the POE-based module in conjunction with ethnoscience. The data were collected through pretests and posttests, and t-test and Pearson correlation test were applied to compare these with the aid of SPSS software. By doing so, the research is able to prove empirically the impact of the module in promoting the understanding of the students.

The research design used is a one group pretest-posttest design, where students are given a pretest before learning using the module and a posttest after learning. This design aims to determine changes in learning outcomes after treatment is given. In this design, the pretest results are used as initial data to measure students' understanding before using the module. After learning is complete, a posttest is conducted to evaluate the increase in students' understanding. The comparison between the pretest and posttest results will be analyzed statistically to determine the effectiveness of the module.

Table 1. Research Design

Group	Pretest	Treatment (POE Ethnoscience Module)	Posttest
Experiment	O1	X	O2

Information:
O1 = Pretest (before using the module)
X = Learning using modules
O2 = Posttest (after using the module)

The subjects of this study were all grade XI students at Senior High School 8, Jambi City. The population was chosen because static fluid material is instructed at grade XI level according to the corresponding curriculum. In addition, this school was chosen because it had previously carried out module development research. Research sample was 70 grade XI students selected using purposive sampling techniques (Sumaryadi, 2024; Sriyono, 2024). Such a sample was selected based on some parameters like general knowledge regarding static fluid material and involvement in learning activities. By selecting right samples, research can obtain more valid information regarding the effectiveness of the module towards increasing the comprehension of the learners (Suhara et al., 2022; Sirait & Ratti, 2024).

This research was conducted in several systematic stages. The first stage is the preparation stage, which includes the preparation of research instruments, validation of pretest and posttest questions, and preparation of modules to be used in learning. In addition, coordination was carried out with subject teachers to ensure the smooth implementation of the research in the classroom. The second stage is the research implementation stage. At this stage, students are given a pretest to determine their initial understanding of the static fluid material. After that, learning using the POE module integrated with ethnoscience is carried

out according to the learning syntax that has been designed. After the learning is complete, students are given a posttest to measure their increase in understanding.

The third stage is the data analysis stage, where the pretest and posttest scores are compared through a t-test to determine whether there is a significant difference in the learning outcomes before and after using the module. A Pearson correlation test was also run to see the relationship between module use and the level of student understanding. The results of this analysis will be used to draw conclusions about the effectiveness of the module in improving student learning outcomes.

The research instruments are two in total and consist of learning outcome tests and student response questionnaires. The learning outcome test is a multiple-choice test, which has been validated and found to be reliable. Pretest and posttest are used to ascertain the increase in student understanding after using the module. The student response questionnaire is also used to ascertain student motivation and participation in the learning process. This combination of instruments provides a more comprehensive picture of the impact of the module on learning. The learning outcome test grid and student response questionnaire may be seen in the table 2.

Table 2. Student Learning Outcome Test Grid

No.	Grid	Number of Questions
1.	Understanding the concept of hydrostatic pressure	10 Questions
2.	Analyzing Archimedes' law	
3.	Calculating pressure on liquids	
4.	Analyzing lifting force on floating objects	
5.	Predicting physics events based on ethnoscience	

Table 3. Student Response Questionnaire Grid

No.	Indicators	Assessment Aspects	Number of statements
1.	Module Readability	Language, Clarity of Information	12 Items
2.	Material Relevance	Suitability of Material with Local Wisdom	
3.	Active Engagement	Predict, Observe, Explain Activities	
4.	Conceptual Understanding	Ease of Understanding Concepts	
5.	Module Interest	Module Design and Illustration	
6.	Learning Motivation	Student learning motivation	

The student response questionnaire consists of 12 statement items using a 4-point Likert scale with categories as in table 4.

Table 4. Range and Categories of Student Responses

Intervals	Category
12-21	Very bad
22-30	Bad
31-39	Good
40-48	Very good

The analysis technique used were Pearson correlation test and t-test through SPSS. Data analysis technique used in this study were the Assumption Test (normality test, linearity test, and homogeneity test), t-test, and Pearson correlation test. Normality test was executed through Kolmogorov-Smirnov to determine whether data were drawn from a population that is normally distributed. Linearity test was conducted to ensure that the data were evenly distributed, and homogeneity test was conducted to ensure that the data were evenly distributed and normally distributed. In the event of normally and evenly distributed data, the t-test is utilized to monitor the difference in learning achievements before and after treatment (Rosdiana et a., 2022; Mubarrok et al., 2025). Meanwhile, after the data was linearly and normally spread, the Pearson

correlation test was conducted to monitor the correlation of students' responses on the module with their understanding of the static fluid material (Suroso et al., 2024; Firmansyah et al., 2024). The method of analysis provides more accurate results in examining the impact of using the module on students' learning outcomes.

RESULTS AND DISCUSSION

POE-based module, infused with ethnoscience used in this study, is the product of development undergone through a series of steps including feasibility testing. Module development based on the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) was implemented and tested using experts from material, media, and language fields. The results of the feasibility test indicate that the module may be utilized for learning by expert judgments and teacher response. Additionally, tests for small group trials have also been conducted to its moderate limit to ensure that the module may be utilized in learning in an efficient manner. Therefore, the present study conducted dissemination of the module developed.

Student Response Results to the Module

Table 5. Results of Student Response Descriptions Regarding the Use of Modules

Intervals	Category	Frequency	Percentage	Mean
12-21	Very bad	0	0.0%	47
22-30	Bad	5	7.1%	
31-39	Good	9	12.9%	
40-48	Very good	56	80.0%	
		70	100.0 %	

Student response questionnaire was used to gauge how much the module would drive their learning participation and motivation. From the result of the analysis, the average student response score was 80%, which is in the very good category. Most of the students indicated that the module explained the concepts more effectively, especially because of the embedding of local wisdom that brings the material closer to real life. This aligns with the research of Khery et al., (2025) which shows that the ethnoscience approach can increase student motivation to study.

Assumption Test Results

Table 6. Results of Data Normality Test

Data	Kolmogorov-Smirnov (Sig.)	Conclusion
Pretest Data	0.087	Normal
Posttest Data	0.124	Normal
Student Response Data	0.150	Normal

Before the t-test and correlation test, the data were tested for normality using the Kolmogorov-Smirnov test. The results of the analysis showed that the significance value of the pretest data was 0.087 and the posttest data significance value was 0.124, both of which were greater than 0.05. This implies that the data is normally distributed, hence a t-test can be used to compare learning outcomes differences before and after the use of the module. Student response data to the use of the module are also normally distributed with the significance value 0.150, which implies that it can go ahead to the correlation test.

Table 7. Linearity Test

Independent Variable	Dependent Variable	Sig. (p-value)	Description
Student Response	Student Understanding (Posttest)	0.041	Linear

The result of the linearity test provides the value 0.041, which is below the commonly accepted significance level, 0.05. This indicates that there is a strong linear relationship between student answers and students' understanding of static fluid material. Linearly distributed data can be extrapolated for the Pearson correlation test.

Table 8. Homogeneity Test Results

Data	Sig.	Distributed
Pretest Data Posttest Data	0.210	Homogeneous

The results of the homogeneity tests have a significance level greater than 0.05, namely 0.210, meaning the data is distributed homogeneously. Data that is significant and has met the criteria of homogeneity can further be subjected to a t-test to investigate differences in learning outcomes before and after using the module.

T-Test Results (Paired Sample t-Test)

Table 9. t-Test Results

Sample	Data	N	Mean	Sig.(2-tailed)
Grade XI	Pretest	70	65.4	0.000
	Posttest	70	85.7	

The t-test was employed to determine whether there was a significant difference between the pretest and posttest scores. The analysis showed that the mean pretest score was 65.4 whereas the mean posttest score was 85.7. The result of the t-test showed a significance value of 0.000 ($p < 0.05$), which means that there was a significant difference in learning outcomes prior to and subsequent to the use of the module. Therefore, it can be said that the application of POE-based modules combined with ethnoscience is effective in enhancing students' comprehension of static fluid material.

Pearson Correlation Test Results

Table 10. Correlation Test

Independent Variable	Dependent Variable	Correlation Coefficient (r)	Sig. (p-value)	Description
Student Response	Student Understanding (Posttest)	0.762	0.001	Significant Positive Correlation

To determine the relationship between module use and students' conceptual understanding, Pearson correlation test was conducted between posttest scores and students' response scores on the module. The findings showed that the correlation value (r) was 0.762 with a significance level of 0.001 ($p<0.05$), and therefore a sign of significant positive correlation between module use and student understanding. This means that the more the use of the module by the students, the more they will be aware of the concept of static fluids.

These results indicate that the higher the students' positive response to the module, the higher the conceptual understanding obtained. This finding is consistent with Gyeltshen & Wangchuk, (2025) research which states that POE-based learning can improve conceptual understanding through active student

involvement. The interactions that occur in each stage of POE allow students to test their initial hypotheses, correct conceptual errors, and strengthen experience-based understanding.

The results of this study indicate that the use of POE-based modules integrated with ethnoscience has a significant impact on improving students' conceptual understanding. Integration of local wisdom in learning helps students to understand abstract concepts more contextually, making learning more meaningful (Bukoye & Abdulrahman, 2023; Sugiarto et al., 2025). The use of ethnoscience also provides opportunities for students to relate physics concepts to everyday life, strengthen conceptual understanding, and increase a sense of belonging to local culture (Jubba et al., 2023; Irjayanti & Lord, 2024).

Compared to the previous ubiquitous lecture method, the approach has the potential to boost student engagement and improve the embedding of subject material into everyday life (Burns, 2015; Alfarisi et al., 2024). This aligns with the contribution of Rayes et al., (2023) in emphasizing the merits of an ethnoscience approach in deepening the knowledge of scientific concepts. The results of this study are consistent with the results of Erdem & Uyanik (2022) that announced the POE method is effective in strengthening the understanding of science concepts. Meanwhile, research by Rayes et al., (2023) emphasized the incorporation of ethnoscience can strengthen the connection between scientific concepts and local culture. However, this study adds a new contribution through the combination of the two approaches, which have not been widely studied in learning physics. The power of the approach is the active involvement of students in the prediction, observation, and explanation process of learning supported by the linkage of physics concepts to the local way of life (Walton, 2012; Mackay et al., 2014; Pastera, 2024).

However, this study has limitations in the small sample size and quasi-experimental design that may impede the generalizability of the results. Further research is recommended to have a larger population and utilize a more rigorous experimental design to confirm these results. Additionally, using POE-based modules integrated with ethnoscience in other subjects such as Chemistry and Biology can also be considered to expand the application of this approach to science learning. The outcomes of this study have significant significance in the world of education. POE integration with ethnoscience can be employed as a new approach in developing context-dependent teaching materials. Not only does it maximize students' comprehension at the conceptual level but also maximizes their cultural appreciation at the local level (Artasia et al., 2022; Erkkilä et al., 2023). The scientific contribution is the creation of educational materials that are empirically grounded and culturally responsive (Shamir-Inbal & Blau, 2016; Huda et al., 2017). This research also presents opportunities for creating such educational materials in other subjects like Chemistry and Biology. Hence, the conclusions of this study contribute to the development of new teaching materials based on a contextual approach and empirical evidence.

CONCLUSION

According to the findings of the study, it can be inferred that the POE-based Physics module integrated with ethnoscience is effective in enhancing student learning outcomes. The t-test results indicated a significant difference between the pretest and posttest, whereas the correlation test results indicated a strong positive correlation between the application of the module and students' comprehension of the concept. In addition, the student reactions to the module were very good, indicating that the POE and ethnoscience-based approach provided a better and more fulfilling learning experience. Thus, this module is recommended to be applied more widely in Physics learning, especially in static fluid material. Further research can test the effectiveness of this module in a broader learning context and develop POE and ethnoscience-based learning strategies for other materials in Physics.

ACKNOWLEDGMENTS

The author would like to thank all parties who have supported and assisted in the implementation of this research, especially the schools and students who participated in the research. Appreciation is also conveyed to the experts who have provided valuable input during the module development process.

REFERENCES

Afrilyasanti, R., Suhartoyo, E., & Widiati, U. (2025). Researching the use of e-portfolios to promote students thinking in digital age: a qualitative action study. *Interactive Technology and Smart Education*, *22*(1), 25-42. https://doi.org/10.1108/ITSE-08-2023-0167.

Al Farisi, M. Z., Maulani, H., Hardoyo, A. B., Khalid, S. M., & Saleh, N. (2024). Investigating Arabic language teaching materials based on Indonesian folklore: an ethnographic study on the folktale of "Bandung". *Asian Education and Development Studies*, *13*(2), 134-149. https://doi.org/10.1108/AEDS-07-2023-0082.

Amelia, E. A., Maison, M., & Kamid, K. (2021). Development of E-Modules using professional 3D pageflip to remediate misconceptions of junior high school students on liquid pressure materials. *EduFisika: Jurnal Pendidikan Fisika*, *6*(2), 72–83. https://doi.org/10.59052/edufisika.v6i2.14522.

Anggraeni, F. D. R., Rassy, R. P., & Sereesuchat, S. (2023). Development of a textured picture book equipped with crosswords as a media for learning biology sub-material epithelial tissue. *Journal of Educational Technology and Learning Creativity*, *1*(2), 68-77. https://doi.org/10.37251/jetlc.v1i2.793.

Arsal, T., Setyowati, D. L., & Hardati, P. (2023). The inheritance of local wisdom for maintaining peace in multicultural society. *Journal of Aggression, Conflict and Peace Research*, *15*(2), 137-151. https://doi.org/10.1108/JACPR-01-2022-0673.

Artasia, M., Hartono, H., & Da Ary, D. (2022). Ethno pedagogy and conservation practices of the erai-erai dance in the Lematang Malay Community, Lahat District, South Sumatra Indonesia. *International Journal of Visual and Performing Arts*, *4*(2), 193–200. https://doi.org/10.31763/viperarts.v4i2.899.

Baharuddin, F. R., Amiruddin, A., Nurlaela, N., & Setialaksana, W. (2024). Teacher growth mindset and ICT integration in Indonesian classrooms: insights from in-service and preservice teacher programs. *Quality Assurance in Education*, *32*(2), 197-212. https://doi.org/10.1108/QAE-08-2023-0136.

Bouchee, T., de Putter-Smits, L., Thurlings, M., & Pepin, B. (2022). Towards a better understanding of conceptual difficulties in introductory quantum physics courses. *Studies in Science Education*, *58*(2), 183-202. https://doi.org/10.1080/03057267.2021.1963579.

Budiarti, R. S., Harlis, H., & Siburian, J. (2024). The influence of managerial team e-projects on students' independent attitudes. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, *8*(2), 485–494. https://doi.org/10.22437/jiituj.v8i2.36379.

Bukoye, O. T., & Abdulrahman, A. H. (2023). Organizational culture typologies and strategy implementation: lessons from Nigerian local government. *Policy Studies*, *44*(3), 316-335. https://doi.org/10.1080/01442872.2022.2051467

Burns, H. L. (2015). Transformative sustainability pedagogy: Learning from ecological systems and indigenous wisdom. *Journal of Transformative Education*, *13*(3), 259-276.

Chen, D., & Srimadona, A. (2023). Development of electronic modules using professional pdf flip on measurement materials. *EduFisika: Jurnal Pendidikan Fisika*, *8*(1), 95–100. https://doi.org/10.59052/edufisika.v8i1.22559.

Derex, M. (2022). Human cumulative culture and the exploitation of natural phenomena. *Philosophical Transactions of the Royal Society B*, *377*(1843), 20200311. https://doi.org/10.1098/rstb.2020.0311.

Erdem Özcan, G., & Uyanik, G. (2022). The effects of the "Predict-Observe-Explain (POE)" Strategy on academic achievement, attitude and retention in science learning. *Journal of Pedagogical Research*, *6*(3), 103-111. https://eric.ed.gov/?id=EJ1341654.

Erkkilä, P., Koskenranta, M., Kuivila, H., Oikarainen, A., Kamau, S., Kaarlela, V., Immonen, K., Koskimäki, M., & Mikkonen, K. (2023). Ethical and cultural competence of social- and health care educators from educational institutions – Cross-sectional study. *Scandinavian Journal of Caring Sciences*, *37*(3), 642–653. https://doi.org/10.1111/scs.13145.

Firmansyah, E., Baluta, I. B., & Elfaituri, K. (2024). The correlation between students' problem-solving abilities and their mathematical thinking in high school mathematics education. *Interval: Indonesian Journal of Mathematical Education*, *2*(2), 132-140.

https://doi.org/10.37251/ijome.v2i2.1343.
Gill, A. S., Irwin, D., Long, P., Sun, L., Towey, D., Yu, W., Zhang, Y., & Zheng, Y. (2025). Enhancing learning in design for manufacturing and assembly: The effects of augmented reality and game-based learning on student's intrinsic motivation. *Interactive Technology and Smart Education*, *22*(1), 61-80. https://doi.org/10.1108/ITSE-11-2023-0221.
Gyeltshen, S., & Wangchuk, S. (2025). Using the Predict–Observe–Explain (POE) Strategy in enhancing student's conceptual understanding the energy conservation law. *Science & Education*, 1-15. https://link.springer.com/article/10.1007/s11191-025-00625-4.
Haryanto, H., Asrial, A., Sanova, A., Widowati, A., & Saputra, A. (2024). Generic science skills: PHeT applications based on discovery learning. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, *8*(1), 158–169. https://doi.org/10.22437/jiituj.v8i1.32441.
Haryono, C. G., Bungin, B., & Teguh, M. (2025). The guardian of local culture: The dynamic of Indonesian local television to survive against global media onslaught. *Journal of Information, Communication and Ethics in Society*, *23*(1), 117-133. https://doi.org/10.1108/JICES-08-2024-0123.
Hendriyani, D. (2023). E-Module based guided inquiry: Business and energy for senior high schools. *Schrödinger: Journal of Physics Education*, *4*(2), 47-52. https://doi.org/10.37251/sjpe.v4i2.505.
Herlanti, Y., Nobira, S., Kuboki, Y., & Qumilaila, Q. (2025). Online lesson study design: integrating environmental issues with science learning to enhance students' environmental literacy. *International Journal for Lesson & Learning Studies*, *14*(1), 27-40. https://doi.org/10.1108/IJLLS-08-2024-0169.
Holmes, J., Liu, Z., Zhang, L., Ding, Y., Sio, T. T., McGee, L. A., ... & Liu, W. (2023). Evaluating large language models on a highly-specialized topic, radiation oncology physics. *Frontiers in Oncology*, *13*, 1219326. https://doi.org/10.3389/fonc.2023.1219326.
Huda, M., Jasmi, K. A., Mustari, I., Basiron, B., & Sabani, N. (2017). Traditional wisdom on sustainable learning: An insightful view from Al-Zarnuji's Ta 'lim al-Muta 'allim. *SAGE Open*, *7*(1), 2158244017697160.
Ikram, M., Kenayathulla, H. B., & Saleem, S. M. U. (2025). Unlocking the potential of technology usage in fostering education quality and students' satisfaction: a case of Pakistani higher education. *Kybernetes*, *54*(3), 1938-1965. https://doi.org/10.1108/K-03-2023-0452.
Irjayanti, M., & Lord, L. (2024). Operating a business with local wisdom: A grounded research of women in the creative industry. *Cogent Business & Management*, *11*(1). https://doi.org/10.1080/23311975.2024.2392047.
Jamaluddin, A. Bin, Zubaidah, S., Mahanal, S., & Gofur, A. (2022). Exploration of the Indonesian Makassar-Buginese Siri' educational values: The foundation of character education. *International Journal of Evaluation and Research in Education*, *11*(1), 10–19. https://doi.org/10.11591/ijere.v11i1.21670.
Jana, J., Hammidah, H., Chand, R., & Haselkorn, J. (2024). Community Spirit and Local Wisdom: Strengthening Character Education through the Ngarot Tradition in Social Studies Learning. *Journal of Social Knowledge Education (JSKE)*, *5*(1), 9-20. https://doi.org/10.37251/jske.v5i1.888.
Karuku, S. (2023). Systematic literature review: Analysis of the use of website-based physics learning devices to support students' abilities in learning physics in high schools. *Journal Evaluation in Education (JEE)*, *4*(3), 80-87. https://doi.org/10.37251/jee.v4i3.336.
Khery, Y., Hakim, A., Rokhmat, J., & Sukarso, A. (2025). Effectiveness of ethnoscience oriented project to improve students performance. *Multidisciplinary Science Journal*, *7*(8), 2025417-2025417. https://10.31893/multiscience.2025417.
Klein, P., Ivanjek, L., Dahlkemper, M. N., Jelicic, K., Geyer, M. A., Kuchemann, S., & Susac, A. (2021). Studying physics during the COVID-19 pandemic: Student assessments of learning achievement, perceived effectiveness of online recitations, and online laboratories. *Physical review physics education research*, *17*(1), 010117. https://doi.org/10.1103/PhysRevPhysEducRes.17.010117.

Mackay, D., Zundel, M., & Alkirwi, M. (2014). Exploring the partical wisdom of metis for management learning. *Management Learning*, *45*(4), 418-436.

Muangasame, K., & Tan, E. (2023). Phygital rural cultural heritage: a digitalisation approach for destination recovery and resilience. *Worldwide hospitality and tourism themes*, *15*(1), 8-17. https://doi.org/10.1108/WHATT-08-2022-0096.

Mubarrok, W., Dewanti, D. S., & Purna, F. P. (2025). Do external factors affect the level of tourist visits. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, *9*(1), 323–332. https://doi.org/10.22437/jiituj.v9i1.32433.

Mutmainnah, M., Meinarisa, M., & Mulyani, S. (2023). Module and audiovisual package interventions in increasing students' knowledge and hard skill in maternity nursing courses. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, *7*(1), 1–4. https://doi.org/10.22437/jiituj.v7i1.18280.

Nabila Junita, D., & Dev Prasad, R. (2024). The effect of using english animation videos on students' speaking ability. *Journal of Language, Literature, and Educational Research*, *1*(2), 39-44. https://doi.org/10.37251/jolle.v1i2.1063.

Ngao, A. I., & Sang, G. (2024). How teachers enhance ICT integration practices within professional learning communities: a qualitative study in Tanzania. *Journal of Professional Capital and Community*, *9*(4), 377-397. https://doi.org/10.1108/JPCC-04-2023-0029.

Normalita, E., Svonni, C., & Maluleka, P. (2023). Application of discussion methods and memory board games to increase student activity and learning outcomes in history learning. *Indonesian Journal of Education Research (IJoER)*, *4*(6), 147-154. https://doi.org/10.37251/ijoer.v4i6.774.

Nurdauletova, B., Artykbaev, Z., Amirbekova, A., Koshimova, B., Otarova, A., & Zhetkizgenova, A. (2024). Enhancing cultural awareness through project-based learning: A study on historical preservation in Kazakhstan. *Journal of Ethnic and Cultural Studies*, *11*(3), 247–268. https://doi.org/10.29333/ejecs/2214.

Palmgren, E., & Rasa, T. (2024). Modelling roles of mathematics in physics: Perspectives for physics education. *Science & Education*, *33*(2), 365-382. https://doi.org/ 10.1007/s11191-022-00393-5.

Pastera, R. J. P. (2024). Unveiling the Veil: Intangible cultural heritage and the filipino college students. *Journal of Ethnic and Cultural Studies*, *11*(2), 25–41. https://doi.org/10.29333/ejecs/1818.

Perrotta, C., Bailey, C., & Garside, C. (2017). Culture, technology and local networks: Towards a sociology of 'making' in education. *Cambridge Journal of Education*, *3577*(September), 1–17. https://doi.org/10.1080/0305764X.2017.1375459.

Pols, C. F. J., Dekkers, P. J. J. M., & De Vries, M. J. (2021). What do they know? Investigating students' ability to analyse experimental data in secondary physics education. *International Journal of Science Education*, *43*(2), 274-297. https://doi.org/10.1080/09500693.2020.1865588.

Rayes, W. P. A., Herayanti, L., Prayogi, S., & Kurnia, N. (2023). Integration of ethnoscience in science learning: An ethnoscience study on the palm sugar production process. *Lensa: Jurnal Kependidikan Fisika*, *11*(2), 97-115. https://doi.org/10.33394/j-lkf.v11i2.14455.

Rosdiana, S. R., Wulandari, S. A., Susanti, I., Aisyurrahman, D. F., & Setiawan, A. (2022). Student self-efficacy through empirical theoretical student worksheet. *EduFisika: Jurnal Pendidikan Fisika*, *7*(2), 160–168. https://doi.org/10.59052/edufisika.v7i2.21298.

Shamir-Inbal, T., & Blau, I. (2016). Developing digital wisdom by students and teachers: The impact of integrating tablet computers on learning and pedagogy in an elementary school. *Journal of Educational Computing Research*, *54*(7), 967-996.

Sirait, M. C., & Ratti, P. (2024). Building Health Awareness: Analysis of the Relationship between Knowledge and Attitude with BSE Behavior in Public Health Science Students. *Journal of Health Innovation and Environmental Education*, *1*(2), 53-59. https://doi.org/10.37251/jhiee.v1i2.1206.

Socrates, T. P., Ikram, R., Afrizon, R., Hidayat, R., Hidayati, H., & Rozi, N. E. (2023). Physics educational game contains scientific literacy and ethnoscience on newton's law of motion. *EduFisika: Jurnal Pendidikan Fisika*, *8*(3), 344–355. https://doi.org/10.59052/edufisika.v8i3.29670.

Sriyono, S. (2024). Improving learning results in hydrocarbon chemistry with mind mapping and classical music accompaniment. *Journal of Chemical Learning Innovation*, *1*(1), 1-6.

https://doi.org/10.37251/jocli.v1i1.1016.

Sugiarto, E., Syarif, M. I., Mulyono, K. B., Nizam, A., & Krisnawati, M. (2025). How is Ethnopedagogy-based education implemented? (A case study on the heritage of batik in Indonesia). *Cogent Education*, *12*(1). https://doi.org/10.1080/2331186X.2025.2466245.

Suhara, Y. I., Siska, N. D., Fadilah, A. F., & Supriyadi, M. A. (2022). Comparative analysis of electronic modules with print modules in social studies learning to see environmental care character indicators. *Journal of Basic Education Research*, *3*(3), 69-75. https://doi.org/10.37251/jber.v3i3.269.

Sumaryadi, S. (2024). Contribution of agility and speed to ball drifting skills in students football extracurricular. *Multidisciplinary Journal of Tourism, Hospitality, Sport and Physical Education*, *1*(1), 21-26. https://doi.org/10.37251/jthpe.v1i1.1040.

Supriyadi, S., Wati, M., Miriam, S., & Sasmita, F. D. (2022). Effectiveness of authentic learning contained modules on straight motion materials to train problem solving skills. *EduFisika: Jurnal Pendidikan Fisika*, *7*(1), 62–71. https://doi.org/10.59052/edufisika.v7i1.19877.

Suroso, S., Solaiman, S. M., & Fanani, A. (2024). The relationship between the effectiveness of school principal leadership in improving the quality of education. *Jurnal Pendidikan Agama Islam Indonesia (JPAII)*, *5*(2), 43-49. https://doi.org/10.37251/jpaii.v5i2.885.

Umi Fatimah, F. N., & Siswanto, J. (2022). Analysis of critical thinking ability of students vii of smp using esd-based POE model on static electricity materials. *EduFisika: Jurnal Pendidikan Fisika*, *7*(1), 102–107. https://doi.org/10.59052/edufisika.v7i1.20017.

Walton, S. A. (2012). Annals of science technology and culture in Greek and Roman antiquity. *Taylor & Francis*, *69*(2), 256–297. https://doi.org/10.1080/00033790902898359.

Yulianti, S., & Awingan, J. S. (2024). The relationship between assertive behavior and academic achievement of biology education students: The contribution of assertive behavior in improving academic outcomes. *Journal of Academic Biology and Biology Education*, *1*(2), 46-55. https://doi.org/10.37251/jouabe.v1i2.1167.

Yusra, D. M., Citra, Y. D., & Rosnita, R. (2023). Explicit instruction based e-module development on momentum and impulsive material. *Integrated Science Education Journal*, *4*(1), 14-19. https://doi.org/10.37251/isej.v4i1.295.

Yustitia, V., Murti, V. S., Kusmaharti, D., & Faridah, L. (2025). Enhancing students' critical thinking in numeracy problem-solving through a field-independent learning style and high self efficacy. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, *9*(1), 119–129. https://doi.org/10.22437/jiituj.v9i1.36525.