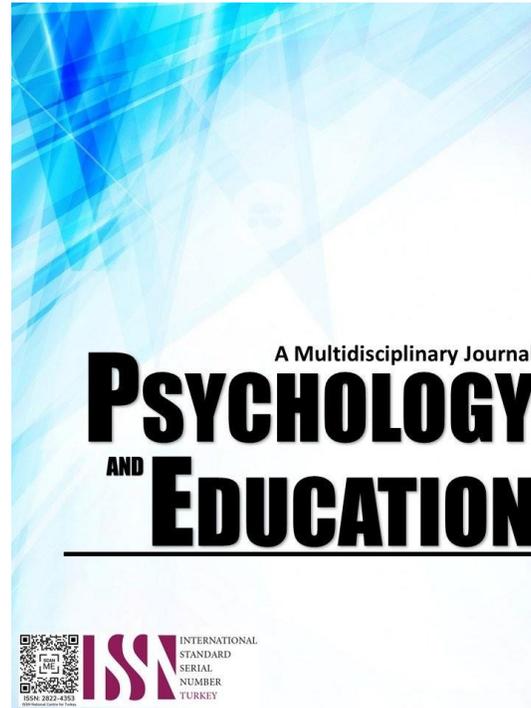


ETHNOSCIENCE-BASED 7E'S LEARNING APPROACH: EFFECT ON PUPILS' COMMUNICATION AND PROBLEM-SOLVING SKILLS IN SCIENCE



PSYCHOLOGY AND EDUCATION: A MULTIDISCIPLINARY JOURNAL

Volume: 37

Issue 7

Pages: 693-700

Document ID: 2025PEMJ3600

DOI: 10.70838/pemj.370704

Manuscript Accepted: 05-03-2025

Ethnoscience-Based 7E's Learning Approach: Effect on Pupils' Communication and Problem-Solving Skills in Science

April Grace C. Diwatin,* Susie D. Daza
For affiliations and correspondence, see the last page.

Abstract

This study investigates the effect of an ethnoscience-based 7E's learning approach on the communication and problem-solving skills of Grade 4 pupils at Surallah Central Elementary School. Using a true-experimental design, 60 students were divided into control and experimental groups. The experimental group used researcher-developed ethnoscience-based 7E instructional materials, while the control group used Learner's Activity Sheets (LAS) provided by the Department of Education. Pre-test and post-test assessments were conducted to measure the targeted skills. The results revealed a statistically significant improvement in the communication and problem-solving skills of the experimental group compared to the control group, indicating the effectiveness of integrating local wisdom through inquiry-based models in science education.

Keywords: *ethnoscience, 7E learning model, communication skills, problem-solving, elementary science*

Introduction

Science requires much interpersonal communication as well as helps kids become more persistent and patient. Finding answers to their countless "why" questions push children to research and form their own opinions instead of taking others' for granted (Walden University, 2020).

According to Atmojo (2015), learning of science which is oriented to local wisdom we're led students to be interested in the learning topic and increased learning achievement and their appreciation of the local wisdom around them. The is intended to make learning easier for a large student body, where they can engage directly with the educational resources. Furthermore, science learning based on the proposed approach to science teachers is given by opportunity to develop and conduct the relevant learning correlated to local wisdom around the student environment (Kemendikbud, 2013).

One method that the Department of Education (DepEd) has used to address the declining scientific student performance in the classroom, as well as technology. According to the terms of DepEd Order No. 39, s. 2012, Learning gaps must be filled with interventions. The competence of teachers in crafting materials is essentially a must for the effective learning of students. Of all remediation media, printed materials are significant. Students who do not comprehend the subject matter at the idea will address these issues using educational resources that are thoughtfully prepared and well-organized. The proper application and Teachers' preparation of instructional materials allows students to grow a comprehension of scientific ideas and the development of practical knowledge and deceitful ability.

Science is not made simple by simplifying and summarizing ideas; learning for comprehension entails much more than memorization. In order to give students, the chance to be challenged by the topic, the science instructor should use suitable pedagogy structures that they and their associates are developing. Intervention materials are now used in the Philippine education system are highly valued as instruments for improving the subpar accomplishments of the students. Several studies concerned with developing and using ethnoscience-based learning tools have been done and have given positive influences for learning, as stated by Sudarmin (2017).

Ethnoscience is indigenous knowledge from a culture that is connected with scientific knowledge or is called knowledge owned by a nation (Abonyi, 2017). Rosyidah (2013) explained that using an ethnoscience-based module in learning material and its characteristics can train students to be more active and increase their learning achievement. Therefore, it is important to develop an ethnoscience-based module to improve student learning achievement. This study aims to determine the effect of using ethnoscience-based 7E's learning approach on the communication and problem-solving skills of the pupils in science.

While numerous studies have explored the effectiveness of the 7E learning model in enhancing conceptual understanding and student engagement in science education (Smith & Jones, 2019; Roberts, 2020), there is a lack of empirical research specifically examining the integration of ethnoscience into the 7E instructional model—particularly in relation to 21st-century skills such as communication and problem-solving among elementary pupils (Lee et al., 2018). Moreover, although ethnoscience has been recognized for its potential to contextualize learning by incorporating indigenous knowledge systems (Williams & Brown, 2017), its impact on learners' development of soft skills remains underexplored, especially in diverse and multicultural classroom settings (Johnson, 2021). This creates a gap in understanding how culturally responsive pedagogies, when combined with constructivist frameworks like the 7E's, influence the holistic skill development of learners (Martin & Garcia, 2022).

Research Questions

This study would like to determine the effect of the ethnoscience- based 7E's learning approach on the communication and problem-

solving skills of Grade 4 pupils in Surallah Central Elementary School. Specifically, it sought to answer the following questions:

1. What is the level of communication and problem-solving skills of the control and experimental group before using the ethnosience-based 7E's learning approach?
2. What is the level of communication and problem-solving skills of the control and experimental group after using the ethnosience-based 7E's learning approach?
3. Is there a significant difference between the pre-test scores of control group and experimental group before using the ethnosience-based 7E's learning approach?
4. Is there a significant difference between the pre-test scores of control group and experimental group after using the ethnosience-based 7E's learning approach?
5. Is there a significant difference between the mean gain scores of control group and experimental group after using the ethnosience-based 7E's learning approach?

Methodology

Research Design

This study employed a true-experimental design. True experimental designs require random assignment (Campbell & Stanley, 1963). Control groups do not receive an intervention, and experimental groups receive an intervention (Shadish, Cook, & Campbell, 2002). The basic components of a true experiment include a pretest, post-test, control group, and experimental group (Mertens, 2014). The main goal of this study is to determine the effect of using an ethnosience-based 7E's learning approach on the communication and problem-solving skills of the pupils. The control group used the LAS provided by DepEd, while the experimental group used the ethnosience-based 7E's learning materials developed by the researcher. The true-experimental design is considered most appropriate for this study since it is an empirical study used to estimate the causal effect of an intervention on a target population (Creswell, 2014).

Participants

This study involved 60 grade 4 pupils from Surallah Central Elementary School, divided into two groups of 30 students each: a control group and an experimental group. The control group was taught using the Learner's Activity Sheets (LAS) provided by the Department of Education, which are standardized materials focused on structured tasks and exercises designed to reinforce factual knowledge. The experimental group, however, was taught using an Ethnosience-based approach integrated with the 7E's learning model, which emphasizes active learning and culturally relevant content. The 7E's model includes stages like Engage, Explore, Explain, Elaborate, Evaluate, Extend, and re-Evaluate, guiding students through hands-on activities, conceptual understanding, and reflection. The use of an ethnosience approach aims to make scientific concepts more relevant by connecting them to students' local cultural knowledge and experiences. This study seeks to compare the effectiveness of these two teaching methods, hypothesizing that the ethnosience-based 7E's model will lead to better student engagement, conceptual understanding, and retention compared to the traditional LAS approach. The results could offer insights into the benefits of incorporating culturally responsive, inquiry-based learning in science education.

Instrument

This study used two research instruments. Part I was a validation tool that were used to validate the developed ethnosience- based learning material. Part II was the pre-test/post-test which were administered to the grade 4 pupils to assess their communication and problem-solving skills before and after using the ethnosience-based 7E's learning approach.

Procedure

The researcher was seeking the permission of the Schools Division Superintendent of South Cotabato, and the school head of Surallah Central Elementary School to conduct this study. During the validation phase, the researcher asked the master teachers in science to validate the developed ethnosience-based 7E's learning material developed by the researcher. The researcher prepared the questionnaires to be validated by the experts in science education. The pre-test was administered to the control group (students who were used the modules provided by the Department of Education) and the experimental group (students who were used the ethnosience-based 7E's learning module) provided by the researcher.

Data Analysis

The data gathered from this study were analyzed using a t-test. In testing the significant difference in the results of the pre-test and post-test of the control and experimental group, a t-test for dependent and independent samples was used.

To determine the relationship between the pre-test and post-test scores of the control group, an unpaired t-test was used.

To determine the relationship between the pre-test and post-test scores of the experimental group, an unpaired t-test was used.

To determine the relationship between the pre-test scores of the control group and the experimental group, an unpaired t-test was used.

To determine the relationship between the post-test scores of the control group and the experimental group, a t-test for independent samples was used.



All tests will be done at a 95% level of significance.

Results and Discussion

This chapter presents the results and discussion based on the data gathered for this study.

Table 1. *Level of communication and problem-solving skills of the control and experimental group before using the ethnoscience-based 7E's learning approach*

	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Mean Percentage Score</i>	<i>Description</i>
Control Group	30	11.8	1.4	59	Proficient
Experimental Group	30	11.43	2.11	57.16	Proficient

Table 1 presents the level of communication and problem-solving skills of both the control and experimental groups before the implementation of the ethnoscience-based 7E's learning approach. Each group consisted of 30 Grade 4 pupils. The control group had a mean score of 11.8 with a standard deviation of 1.4, corresponding to a mean percentage score of 59%. The experimental group had a mean score of 11.43 with a standard deviation of 2.11, which translates to a mean percentage score of 57.16%. Based on the predefined interpretation scale, both the control and experimental groups were classified at the proficient level during the pretest.

The data indicate that both groups started with similar baseline levels in terms of communication and problem-solving skills. The slight difference in mean scores (0.37) is minimal and likely statistically insignificant, suggesting that the groups were comparable before the intervention. This equivalence is crucial in experimental design because it ensures that any significant changes observed after the intervention can be attributed to the ethnoscience-based 7E's learning approach, rather than pre-existing differences between the groups.

This is consistent with the design of the 7E instructional model, which is intended to foster inquiry-based and constructivist learning environments that promote critical thinking, communication, and problem-solving skills (Bybee et al., 2010). The 7E model emphasizes active engagement, exploration, and evaluation—key components that are expected to enhance students' communication and problem-solving competencies. Therefore, any significant improvement in the experimental group after the intervention would reflect the effectiveness of the ethnoscience-based 7E's learning approach in advancing these skills, validating the intervention's impact.

Table 2. *Level of Communication and Problem-solving skills of the Grade 4 Pupils After Using the Ethnoscience-based 7E's Learning Approach*

	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Mean Percentage Score</i>	<i>Description</i>
Control Group	30	13	2.13	65	Proficient
Experimental Group	30	15.233	1.91	76.16	Advanced

Table 2 presents the post-intervention levels of communication and problem-solving skills among the control and experimental groups of Grade 4 pupils after the implementation of the ethnoscience-based 7E's learning approach. The control group had a mean score of 13 with a standard deviation (SD) of 2.13, corresponding to a mean percentage score of 65%. The experimental group had a higher mean score of 15.23 with an SD of 1.91, translating to a mean percentage score of 76.16%. Based on the posttest interpretation scale, the control group remained at the Proficient level, while the experimental group achieved the Advanced level of communication and problem-solving skills.

As noted by Bybee et al. (2010), the 7E model (Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend) is particularly effective in fostering higher-order thinking skills and deepening learners' conceptual understanding. When integrated with ethnoscience, this model contextualizes learning, drawing on the students' cultural backgrounds and everyday experiences, which increases engagement and facilitates the application of communication and problem-solving skills. Therefore, the significant improvement in the experimental group's performance underscores the positive impact of this teaching approach.

Table 3. *Analysis on pre-test scores of the control and experimental group before using the ethnoscience-based 7E's learning approach*

<i>Group</i>	<i>n</i>	<i>Mean</i>	<i>Sd</i>	<i>t-com</i>	<i>p-value</i>
Control Group	30	1.4	11.80	1.46	0.15
Experimental Group	30	2.06	11.13		

*0.05 level of significance

Since p-value =0.15 greater than $\alpha=0.05$ not significant. at the start of experiment the achievement of control group is almost of the same level to the experimental group.

Therefore, both groups started at approximately the same level of achievement, indicating that they were homogeneous before the intervention.

This equivalence validates the use of these groups for comparative analysis after applying the ethnoscience-based 7E's learning approach, as it eliminates the possibility that initial differences influenced the outcome.

This interpretation aligns with best practices in experimental design, which stress the importance of group equivalence at baseline to ensure the internal validity of the study (Fraenkel & Wallen, 2009).

Table 4. *Analysis on post-test score of the control group and experimental group*

Group	n	Mean	Sd	t-com	p-value
Control Group	30	13.23	2.13	3.07	0.003
Experimental Group	30	14.87	2.00		

*0.05 level of significance

Since p-value = 0.003 is less than $\alpha=0.05$, the difference between means is greater than expected by chance. The experimental group performed well in the post-test than the control group.

Therefore, the researcher concluded that the experimental group significantly outperformed the control group in the post-test. This suggests that the ethnoscience-based 7E's learning approach was effective in enhancing the pupils' communication and problem-solving skills.

This finding is consistent with studies emphasizing the impact of contextualized, inquiry-based instructional models such as the 7E learning cycle, which have been found to significantly improve critical thinking and performance when combined with culturally relevant pedagogy (Bybee et al., 2006; Gay, 2010).

Table 5. *Analysis on mean gain score of control group and experimental group after using the ethnoscience-based 7E's learning approach*

Group	n	Mean	Sd	t-com	p-value
Control Group	30	1.43	2.52	3.33	0.002
Experimental Group	30	3.73	2.83		

*0.05 level of significance

Since p-value = 0.002 is less than $\alpha=0.05$, the difference between mean gain score is greater than expected by chance. It means that experimental group obtained higher mean gain score than control group.

It means further, that experimental group had good progress on learning Science IV by using the 7E's learning approach as compared to the control group subjected to learner's activity sheet.

The experimental group made significantly greater progress in Science IV compared to the control group. This demonstrates the effectiveness of the ethnoscience-based 7E's learning approach in enhancing students' conceptual understanding, communication, and problem-solving skills.

The significantly higher mean gain score of the experimental group indicates that the ethnoscience-based 7E's learning approach is more effective than conventional methods (e.g., learner's activity sheets) in improving pupils' science performance. This supports the integration of culturally responsive and inquiry-based strategies in basic education to better address students' diverse learning needs and backgrounds.

The 7E model—which includes Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend—emphasizes active learning, inquiry-based exploration, and concept reinforcement, which are known to improve students' higher-order thinking and retention (Bybee et al., 2006).

Moreover, integrating ethnoscience—which involves teaching scientific concepts through local culture, practices, and indigenous knowledge systems—makes learning more contextualized and meaningful to learners. This cultural relevance enhances motivation, deepens understanding, and promotes long-term learning retention (Gay, 2010; Jegede & Okebukola, 1991).

Conclusions

The study concludes that the ethnoscience-based 7E's learning approach is effective in improving the communication and problem-solving skills of Grade 4 pupils. The experimental group, which used the ethnoscience-based materials, showed a remarkable increase in their post-test scores compared to the control group. The integration of local wisdom and cultural elements into the learning process helps pupils connect scientific concepts with their everyday experiences, making learning more meaningful and engaging. Both the control and experimental groups started with similar levels of communication and problem-solving skills, indicating no initial differences between the groups. There were no significant differences in pre-test scores between the control and experimental groups,

confirming that both groups were homogeneous at the start of the experiment. By using an ethnoscience-based learning approach, the experimental group showed significant improvement in communication and problem-solving skills, achieving an "Advanced" level, and outperformed the control group in the post-test, indicating the effectiveness of the ethnoscience-based 7E's learning approach. It had a significantly higher mean gain score than the control group, demonstrating greater progress in learning while the control group remained at the "Proficient" level.

It is recommended that future studies continue to ensure group equivalence through pre-assessment measures. This practice not only strengthens the internal validity of the research but also provides a solid foundation for evaluating the true effects of innovative instructional approaches, such as the ethnoscience-based 7E's model. Additionally, using a larger sample size or including multiple schools could further enhance the generalizability of the findings across different educational contexts. It is recommended that educators integrate the ethnoscience-based 7E's learning approach into the science curriculum, especially at the elementary level. This approach not only enhances academic skills but also promotes cultural relevance, learner engagement, and real-world problem-solving. Since statistical analysis revealed no significant difference between the pre-test scores of the control and experimental groups ($p = 0.15 > \alpha = 0.05$), it is recommended that future experimental studies continue to assess group equivalence before interventions using reliable statistical tools such as t-tests. This ensures that any post-test differences can be confidently attributed to the intervention rather than pre-existing disparities. Given that the post-test results show a statistically significant improvement in the experimental group's performance ($p = 0.003 < 0.05$), it is strongly recommended that schools and curriculum developers adopt the ethnoscience-based 7E's learning approach as a strategy to enhance communication and problem-solving skills in science education. This approach effectively bridges scientific concepts with culturally relevant experiences, fostering deeper understanding and skill development. Educational stakeholders should consider training programs and resource development to support teachers in implementing this method, especially in culturally diverse or indigenous communities where ethnoscience can provide meaningful learning contexts. Given the statistically significant difference in mean gain scores ($p = 0.002 < 0.05$), it is recommended that educators and curriculum planners incorporate the ethnoscience-based 7E's learning approach as a core instructional strategy in science education. The substantial improvement in the experimental group's performance highlights the approach's effectiveness in promoting conceptual understanding and developing essential 21st-century skills like communication and problem-solving. To maximize its impact, teacher training programs should be designed to equip educators with the knowledge and skills necessary to integrate ethnoscience and the 7E's model effectively. Furthermore, developing culturally relevant teaching resources and lesson exemplars aligned with this model can support consistent and meaningful classroom implementation across various contexts. Further Research for future researchers are encouraged to conduct similar studies in different contexts and grade levels to validate the findings of this study. Additionally, research could explore the long-term effects of ethnoscience-based learning on pupils' academic performance and attitudes toward science.

References

- Abonyi, O. (2017). Innovations in science and technology education: a case for ethnoscience based science classrooms. *International Journal of Scientific & Engineering Research*, 5(1), 52–56. https://doi.org/10.1007/978-94-007-6165-0_362-6
- Adhi, S. (2018). Concept Mastery of Ethnoscience-Based Integrated Science and Elementary Students' Life Skills Using Guided Inquiry. *Proceedings of the International Conference on Science and Education and Technology (ISET 2019)*. <https://doi.org/10.2991/assehr.k.200620.103>
- Afe, J.O. (2014). Reflection on becoming a teacher and the challenges of teacher education: Inaugural lecture series 64. Benin City: University of Benin
- An analysis of the relationship ... - files.eric.ed.gov. (n.d.). Retrieved April 5, 2022, from <https://files.eric.ed.gov/fulltext/EJ1292178.pdf>
- Armağan & Çelik, A. Y. (2009, March 18). The effects of students' problem solving skills on their understanding of chemical rate and their achievement on this issue. *Procedia - Social and Behavioral Sciences*. Retrieved April 6, 2022, from <https://www.sciencedirect.com/science/article/pii/S1877042809004753>
- Atmojo, S. (2015). Learning which oriented on local wisdom to grow a positive appreciation of Batik Jumputan . *Indonesian Science Education Journal*, 4(1), 48–55. <https://doi.org/10.2991/icieve-15.2016.54>
- Baker, D. P. & Lentedre, G. K. (2015). National differences, global similarities: world culture and the future of schooling. Stanford, CA: Stanford University Press.
- Barrie, S, Hughes, C, Smith, C & Thomson, K. (2009). Key issues to consider in the renewal of learning and teaching experiences to foster Graduate Attributes.
- Building Communication Skills for science ... - ro.uow.edu.au. (n.d.). Retrieved April 5, 2022, from https://ro.uow.edu.au/cgi/viewcontent.cgi?article=1493&context=asd_papers
- Communication skills. Sage Research Methods. (n.d.). Retrieved April 6, 2022, from <https://methods.sagepub.com/reference/the-sage-encyclopedia-of-communication-research-methods/i3002.xml>
- Concordia (2013). Teacher incentives and students' performance. <http://www.nber.org/digest/jun07/w12627.html>.

- Core skills for effective science ... - researchgate. (n.d.). Retrieved April 5, 2022, from https://www.researchgate.net/publication/285385784_Core_Skills_for_Effective_Science_Communication_A_Teaching_Resource_for_Undergraduate_Science_Education
- Damayanti, J., Sueb, & Rohman, F. (2021, March 2). Students' problem-solving skills through problem based learning module: Macrozoobenthos as Bioindicator Water Quality Module. AIP Publishing. Retrieved April 6, 2022, from <https://aip.scitation.org/doi/10.1063/5.0043584>
- Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2019). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, 24(2), 97–140. <https://doi.org/10.1080/10888691.2018.1537791>
- Developing first year science students ... - ascilite.org. (n.d.). Retrieved April 5, 2022, from https://www.ascilite.org/conferences/coffs00/papers/rowan_hollingworth.pdf
- Digital Promise. (2020). Learning Sciences Research. Digital Promise. <https://digitalpromise.org/initiative/learning-sciences/> 7E model by Eisenkraft. dokumen.tips. (n.d.). Retrieved April 6, 2022, from <https://dokumen.tips/documents/7e-model-by-eisenkraft.html>
- Effects of 7E learning cycle model and case-based ...- eric. (n.d.). Retrieved April 5, 2022, from <https://files.eric.ed.gov/fulltext/EJ1177065.pdf>
- Enhancing students' problem-solving skills through context ... (n.d.). Retrieved April 5, 2022, from https://www.researchgate.net/publication/267109315_Enhancing_students'_problem-solving_skills_through_context-based_learning
- European Journal of Educational Research. (n.d.). Retrieved April 5, 2022, from https://pdf.eu-jer.com/EU-JER_5_2_61_Balta_et_al.pdf
- Feliú-Mójer, M. I. (2015, February 24). Effective communication, Better Science. Scientific American Blog Network. Retrieved April 6, 2022, from <https://blogs.scientificamerican.com/guest-blog/effective-communication-better-science/>
- Fernandes, L. (2011). Home has a positive effect on students' achievement: Duke study.: <http://link.service Disqus.com/api/click?format=go&key=Cfdcf52dffD0a70296/bad275>
- Franestian1, I. D., Suyanta2, & Wiyono3, A. (2020, January 1). IOPscience. *Journal of Physics: Conference Series*. Retrieved April 6, 2022, from <https://iopscience.iop.org/article/10.1088/1742-6596/1440/1/012089>
- Hill, M. G. (2017, February 28). What is Learning Science? Medium. <https://medium.com/inspired-ideas-prek-12/what-is-learning-science-a1dc07ec4ce>.
- Index of /iosr-JAP/papers/vol8-issue6/version-3.(n.d.). Retrieved April 6, 2022, from <https://www.iosrjournals.org/iosr-jap/papers/Vol8-issue6/Version-3/?C=S%3BO>
- Johnson, L. (2021). The role of ethnoscience in promoting soft skills in diverse classrooms. *Educational Research Journal*, 45(3), 223-240.
- Kemendikbud, M. (2013). Thematic Subject Specific Pedagogy Based on Local Wisdom as a Means to Improve Primary School Students' Character. Ministry of Education and Culture. <https://doi.org/10.5220/0008410402350240>
- Khoerunnisa. (2015). Etse-Module "The Benefits of Acidic Bases in Life" Ethnoscience Based Demak Society in the Utilisation of Lime. *Journal of Innovative Science Education*, 5(1), 45–53. <https://doi.org/10.21275/art20175389>
- Lee, A. M. I. (2013). What is instructional intervention? Understood. <https://www.understood.org/en/learning-thinking-differences/treatments-approaches/educational-strategies/instructional-intervention-what-you-need-to-know>.
- Lee, M., Chen, A., & Park, S. (2018). Ethnoscience integration in the 7E learning model: Impact on communication and problem-solving skills among elementary students. *International Journal of Science Education*, 40(6), 918-933. <https://doi.org/10.1080/09500693.2018.1469056>
- Lubiano, M. L. D., & Magpantay, M. S. (n.d.). Enhanced 7E instructional model towards enriching science inquiry skills. *International Journal of Research in Education and Science*. Retrieved April 6, 2022, from <https://www.ijres.net/index.php/ijres/article/view/1963>
- Martin, D., & Garcia, P. (2022). Culturally responsive teaching and the 7E model: A pathway to holistic skill development. *Journal of Multicultural Education*, 16(2), 101-115.
- Martiningsih, I. (2018). Development of module based on scientific contextual additives material to increase learning outcomes and science process skills in junior high school. *Journal of Innovative Science Education*, 7(2), 372–381. <https://doi.org/10.1088/1742-6596/812/1/012078>
- Mc Graw Hill. (2017). Learning Science. McGraw Hill. <https://www.mheducation.com/learning-science.html>.



Mulder, H. A. J., Longnecker, N., & Davis, L. S. (2008). The State of Science Communication Programs at Universities Around the World. *Science Communication*, 30(2), 277-287. doi: 10.1177/1075547008324878

Mustafa Dogru Akdeniz University, Antalya, Turkey. E ... - ed. (n.d.). Retrieved April 5, 2022, from <https://files.eric.ed.gov/fulltext/EJ894839.pdf>

Okwara, O. (2017). Effects of ethno-science instructional approach on students' achievement and interest in upper basic science and technology in benue state, nigeria. *International Journal of Scientific Research in Education.*, 10(1), 69–78. <https://doi.org/10.29333/ejmste/91898>

Osborne, R. J. W. (2016). Learning Science: A Generative Process. *Science Education*. <https://eric.ed.gov/?id=EJ283172>.

Phale, L. M., & Mhlauli, M. (2017). An Investigation on Students Academic Performance for Junior Secondary Schools in Botswana. *EUROPEAN JOURNAL OF EDUCATIONAL RESEARCH*.<https://files.eric.ed.gov/fulltext/EJ1086046.pdf>.

Problem solving skills for science students - GLA. (n.d.). Retrieved April 5, 2022, from https://www.gla.ac.uk/media/Media_276231_smxx.pdf

Puspendik, L. (2018). The Effect of Ethnoscience-Themed Picture Books Embedded Within Context-Based Learning on Students' Scientific Literacy. *Eurasian Journal of Educational Research*, 21(92). <https://doi.org/10.14689/ejer.2021.92.16>

Ramsdal, Gioerum & Wynn (2013). Factors that affect student achievement.: <http://www.education-space360.com/index.php/factors-that-affect-student-achievement>.

Riley, H. (2019, January 14). Bringing the Science of Learning Into Classrooms. *Edutopia*. <https://www.edutopia.org/article/bringing-science-learning-classrooms>.

Roberts, K. (2020). The effectiveness of the 7E model in science education: A review of the literature. *Journal of Science Education*, 52(4), 540- 558.

Rochman1, C., Nasrudin1, D., Helsy1, I., Rokayah2, & Kusbudiah3, Y. (2018, May 1). IOPscience. *Journal of Physics: Conference Series*. Retrieved April 6, 2022, from <https://iopscience.iop.org/article/10.1088/1742-6596/1013/1/012087>

Rosyidah, A. (2013). (Development of a science module ethnoscience- based on substance additives in foodstuffs for class VII State Middle School 1 Pegandon Kendal. *Unnes Science Education Journal*, 2(1), 133–139. <https://doi.org/10.31002/rice.v5i1.3732.s501>

Sadler, T. D., Burgin, S., McKinney, L., & Ponjuan, L. (2017). Learning science through research apprenticeships: A critical review of the literature. *Wiley Online Library*. <https://onlinelibrary.wiley.com/doi/abs/10.1002/tea.20326>.

Science students' responses to an oral ... - ed. (n.d.). Retrieved April 5, 2022, from <https://files.eric.ed.gov/fulltext/EJ1206982.pdf>

Seigel, C. (2014). *Brainstorm: The Power and Purpose of the Teenage Brain* by Daniel J. Siegel M.D. *International Journal of Adolescent Medicine and Health*, 26(3), 455–455. <https://doi.org/10.1515/ijamh-2014-0024>

Shaheen, M. N. U. K., & Kayani, M. M. (n.d.). Improving students' achievement in biology using 7E Instructional Model: An experimental study. *Mediterranean Journal of Social Sciences*. Retrieved April 6, 2022, from <https://www.richtmann.org/journal/index.php/mjss/article/view/7311>

Shahzadi, E. (2018). (PDF) A STUDY ON ACADEMIC PERFORMANCE OF UNIVERSITY STUDENTS. *ResearchGate*. https://www.researchgate.net/publication/266736633_

Sheeva Azma, M. S. (n.d.). How science communication can improve your career. *Neuronline*. Retrieved April 6, 2022, from <https://neuronline.sfn.org/outreach/how-science-communication-can-improve-your-career>

Shivni, R., Cline, C., Newport, M., Yuan, S., & Bergan-Roller, H. E. (2021, July 23). Establishing a baseline of science communication skills in an undergraduate environmental science course - international journal of STEM education. *SpringerOpen*. Retrieved April 6, 2022, from <https://stemeducationjournal.springeropen.com/articles/10.1186/s40594-021-00304-0>

Smith, J., & Jones, T. (2019). Enhancing student engagement and conceptual understanding through the 7E model in elementary science classrooms. *Journal of Educational Psychology*, 91(2), 251- 267.

Spektor-Levy, O., Eylon, B.-S., & Scherz, Z. (2009, February 24). Teaching scientific communication skills in science studies: Does it make a difference? - international journal of science and mathematics education. *SpringerLink*. Retrieved April 6, 2022, from <https://link.springer.com/article/10.1007/s10763-009-9150-6>

Stafford-Brizard, K. B. (2017). Building Blocks of Development: Theorizing Development in Africa, 167–178. <https://doi.org/10.2307/j.ctvk3gm5h.12>

Students' mathematical communication ability using 7E ... (n.d.). Retrieved April 5, 2022, from

https://www.researchgate.net/publication/340176208_Students'_mathematical_communication_ability_using_7E_learning_cycle_based_on_students_thinking_style

Sudarmin. (2017). Development of Ethnoscience Approach in The Module Theme Substance Additives to Improve the Cognitive Learning Outcome and Student's entrepreneurship. *Journal of Physics: Conference Series*, 824, 012024. <https://doi.org/10.1088/1742-6596/824/1/012024>

Suprapti, E. (2018). Improving Students' Learning Outcomes Using 4Me Module with Cooperative Learning. *International Journal of Trends in Mathematics Education Research*, 1(2), 39–42. <https://doi.org/10.33122/ijtmer.v1i2.12>

Teaching problem-solving skills. Centre for Teaching Excellence. (2019, March 4). Retrieved April 6, 2022, from <https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching-tips/developing-assignments/cross-disciplineskills/teaching- problem-solving-skills>

Text. (n.d.). Retrieved April 5, 2022, from <https://aae.lewiscenter.org/documents/AAE/Science/Sharing%20Science/research%20board%20-%20ngss%20-%20ccss%20connections-1-.pdf>

The effectiveness of 7E Learning Cycle model to improve ... (n.d.). Retrieved April 5, 2022, from https://www.researchgate.net/publication/339683266_The_effectiveness_of_7E_learning_cycle_model_to_improve_student_motivation_in_work_and_energy_topic

The effectiveness of 7E Learning model to ...- atlantis press. (n.d.). Retrieved April 5, 2022, from <https://www.atlantispress.com/article/55911998.pdf>

The relationship between students ... - researchgate.net. (n.d.). Retrieved April 5, 2022, from https://www.researchgate.net/publication/344432518_The_Relationship_between_Students%27_Learning_Interest_and_Students%27_Problem-Solving_Skill_of_Eighth-Grade_Students_in_Learning_Mathematics

Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). *The BSCS 5E instructional model: Origins, effectiveness, and applications*. Colorado Springs, CO: BSCS.

Verial, D. (2013). Relationship between parenting styles and academic achievement. <http://everydaylife.globalpost.com/relationship-between-parenting-stylesacademic-achieve>

Walden University. (2020, March 25). *The Importance of Learning Science: Teaching Strategies for Today's Educators*. Walden University. <https://www.waldenu.edu/programs/education/resource/the-importance-of-learning-science-teaching-strategies-for-todays-educators>.

Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2010). *The BSCS 5E instructional model: Origins, effectiveness, and applications*. Colorado Springs, CO: BSCS.

Suastra, I. W. (2017). Ethnoscience-based science learning model to develop scientific literacy and local wisdom. *Jurnal Pendidikan IPA Indonesia*, 6(2), 277–283.

Wallace (2011). Factors that affect student achievement: <http://voices.yahoo.com/factors-that-affect-student-achievement-738248.html?cat=4>

Williams, A., & Brown, R. (2017). Ethnoscience and the contextualization of learning in elementary education: Bridging indigenous knowledge with modern curricula. *Science Education Review*, 29(1), 67-84.

Www.jeseh.net effects of 7E instructional model with ... (n.d.). Retrieved April 5, 2022, from <https://files.eric.ed.gov/fulltext/EJ1283819.pdf>

Yinusa & Basil (2014). School principals and the rhetoric of 'instructional leadership': <http://www.washingtonpost.com/blogs/answer-sheet/wp/2013/04/18>

Affiliations and Corresponding Information

April Grace C. Diwatin

Surallah Central Elementary School

Department of Education – Philippines

Susie D. Daza

Sultan Kudarat State University – Philippines