ISSN (PRINT) : 2549-9955 ISSN (ONLINE): 2549-9963
JURNAL ILMIAH PENDIDIKAN FISIKA
https://ppjp.ulm.ac.id/journals/index.php/jipf/index

The Effect of Ethnoscience-Based Science Environment Technology Society (SETS) Learning Model in Learning Physics and Biology

Gunaria Siagian[1*], Tomi Apra Santosa[2], Festiyed[3], and Yerimadesi[3]
[1]Biology Education, FKIP, Universitas HKBP Nommensen Pematangsiantar Pematangsiantar, Indonesia
[2] Civil Engineering, Adikarya Engineering Academy, Kerinci, Indonesia
[3]Postgraduate, FMIPA, Universitas Negeri Padang, Padang, Indonesia
*Gunariasiagian5@gmail.com

Abstract
This study investigates the effect of the ethnoscience-based Science Environment Technology Society (SETS) learning model on learning Physics and Biology. This type of research involves systematic research, literature reviews, and meta-analyses. The data sources were taken from an analysis of 100 international journals published from 2018 to 2023. Tracing data sources through Google Scholar, Eric, ScienceDirect, and ProQuest. The process of selecting data sources must meet the inclusion criteria analyzed by the JSAP application. The inclusion criteria in this study are: 1) the journal must be published in 2018–2023; 2) SINTA and Scopus/WOS must index the journal; 3) The journal uses experimental or quasi-experimental research methods; and 4) it has an effect size that can be calculated. The data collection technique is direct observation through the journal database. The results showed that the average effect size (ES = 0.873) is a large criterion. These findings explain that the ethnoscience-based Science Environment Technology Society (SETS) model significantly affects science learning. Furthermore, this SETS learning model helps students learn physics and biology more actively and creatively. These results are very important in evaluating the implementation of the school learning system. Furthermore, this ethnoscience-based SETS model must be applied in learning biology and physics to stimulate students to think critically.
Keywords: Education; Science Environment Technology Society; Science Learning

Received : 19 June 2023
Accepted : 14 August 2023
Published : 29 August 2023
DOI : https://doi.org/10.20527/jipf.v7i2.9242

How to cite: Siagian, G., Santosa, T. A., Festiyed, F., & Yerimadesi, Y. (2023). The effect of ethnoscience-based science environment technology society (SETS) learning model in learning physics and biology. *Jurnal Ilmiah Pendidikan Fisika*, 7(2), 342-353.

INTRODUCTION

Learning Physics is a subject that studies natural phenomena (Suendarti & Virgana, 2022; Aydede, 2022). Science learning leads students to scientific and systematic thinking (Bantaokul & Polyiem, 2022; Yakob et al., 2021; Zulkifli et al., 2022; Supriyadi et al., 2023). Utami & Astawan (2020) stated that science learning can directly develop students' thinking skills with the surrounding nature. Science learning encourages students to actively develop scientific processes and attitudes in learning (Kristiana & Radia, 2021; VLin, 2021; Wong et al., 2021; Nuryadin et al., 2022). In addition, science learning helps students explore nature through the facts of scientific concepts (Anjelina et al., 2018; Affilia et al., 2023), so students can solve problems in everyday life (Zorlu & Zorlu, 2021; Akdag & Köksal, 2022). In addition, science learning helps improve science literacy.

The level of student science learning in Indonesia is still relatively low (Jufrida et al., 2019; Kristiyanto et al., 2020). The results of PISA 2018 student science literacy in science learning obtained a score of 396, ranked 71 out of 78 members (Elfira et al., 2023; Ichsan et al., 2023; Suhaimi et al., 2022; Widiana et al., 2022). Adiwiguna et al. (2019) mentioned that the results of PISA 2018 student science literacy in science learning obtained a score of 396, ranked 71 out of 78 members (Bayharti et al., 2019; Suharyat et al., 2023; Fitri et al., 2022). Santosa *et al.* (2021) stated that learning activities are still centered on the teacher, so students are less active in learning. Therefore, an effective learning model is necessary to arouse students' interest in learning, creative and innovative learning (Said & Yerimadesi, 2021; Zulyusri et al., 2023).

SETS is one of the learning models that can improve students' critical and creative thinking skills in science learning. SETS learning model is a learning model that combines Science, Environment, Technology, and Society (SETS) in teaching and learning activities in class (Hidayati et al., 2022). Research results by Yuniastuti (2015) stated that the SETS learning model can encourage student learning outcomes in biology learning. This SETS learning model helps students improve their science process skills (Zahra et al., 2019). Usmeldi et al. (2017) stated that the SETS learning model encourages teachers to improve students' thinking skills in science learning.

In the SETS learning model, students can relate science concepts to the surrounding community environment (Rusilowati et al., 2020). Research results by Suci et al. (2020) showed that the SETS learning model effectively improves students' science learning outcomes at school. Furthermore, the ethnoscience-based SETS learning model improves students' creative and problem-solving skills in learning physics and biology. Research results ethnoscience-based SETS learning models can improve students' understanding of concepts in physics.

Previous research by Gobel et al. (2019) showed that the SETS learning model significantly encourages science process skills in science learning. Sary et al. (2019) research on the process of learning science stated that students must be creative in solving phenomena that occur in life. Research by Ramani (2022) stated that the SETS learning model supports students' thinking process in science learning. However, applying the SETS model in learning activities has not been effective in learning science. Research by Irma et al. (2021) also showed that the application of a good SETS model can improve critical thinking skills in science learning. Based on this problem, this current research investigates the effect of the ethnoscience-based Science Environment Technology Society (SETS) learning model in learning physics and biology.

METHOD

This research is a systematic literature review and meta-analysis. The data source for this research comes from the analysis of 100 international and national journals published from 2018 to 2023. The process of selecting journals for meta-analysis using the PRISMA method can be seen in Figure 1. The process of searching for data sources through Google Scholar, Eric, Taylor &

Francis, ScienceDirect, and ProQuest databases. The data collection technique used direct observation through the journal database.

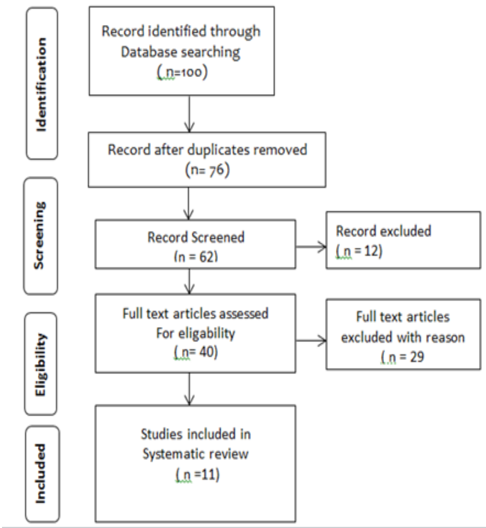

Figure1 PRISMA journal selection process

Inclusion criteria for systematic literature review and meta-analysis are: 1) journals must have been published in 2018–2023; 2) SINTA and Scopus/WOS must index journals; 3) journals must use experimental or quasi-experimental research methods; and 4) journals must have an effect size value that can be calculated. The data analysis in the study was qualitative and quantitative statistical data analysis with the help of the JSAP application. Data analysis to calculate the effect size value, Standard Error, and publication bias test of each data set. Effect Size criteria can be seen in Table 1. Furthermore, quantitative analysis was carried out with the Preferred Reporting Item For Systematic Reviews and Meta-analysis (PRISMA) conducted with a random effect model using DerSimonian and Laird with a degree of confidence (95%) based on the random effect model.

Table 1 Effect size value criteria

Effect Size	Criteria
$0.00 \leq ES < 0.20$	Ignored
$0.20 \leq ES \leq 0.50$	Small
$0.50 \leq ES \leq 0.80$	Medium
$0.80 \leq ES \leq 1.30$	Large
$1.30 \leq ES$	Very Large

Sumber: (Hávard, 2020;Suh et al., 2021)

RESULT AND DISCUSSION

From the results of a meta-analysis of 100 national and international journals related to the effect of the Science Environment Technology Society (SETS) learning model in learning physics and biology, only 12 journals met the inclusion criteria. Furthermore, studies that have fulfilled inclusion criteria calculated the effect size and standard error value, which can be seen in Table 2.

Table 2 Meta-analysis of journals based on inclusion criteria

Code Studi	Year	Hedge's g	Standar Error	Criteria Effect Size
A1	2019	0.71	0.42	Medium
A2	2020	0.68	0.39	Medium
A3	2021	1.20	0.72	Large
A4	2022	0.92	0.57	Large
A5	2018	1.03	0.70	Large
A6	2020	0.64	0.44	Medium
A7	2019	0.28	0.04	Small
A8	2019	0.85	0.46	Large
A9	2020	0.90	0.52	Large
A10	2022	1.34	0.84	Very Large
A11	2022	0.58	0.33	Medium
A12	2021	1.35	0.77	Very Large
Average		0.873		Large

Based on Table 2, the average effect size value of each study that has met the inclusion criteria is 0.873 with large criteria. These results explain that applying the Science Environment Technology Society (SETS) learning model has a major impact on students' Physics and Biology learning. In addition, the search for studies that met the criteria in this meta-analysis was taken from 5 studies from Google Scholar, three from Eric, two from Taylor & Francis, and one from ScienceDirect and ProQuest, which can be seen in full in Figure 2.

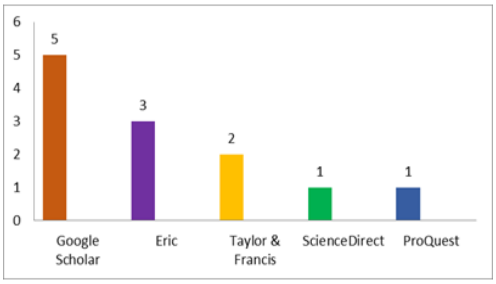

Figure 2 Data source search database

Furthermore, a heterogeneity test was conducted to determine the effect size model used in the study, which can be seen in Figure 3.

Model	Number Studies	Hedge's g	95% CI	Null Hypothesis Test (2-tail)		Heterogenity		
				Z-value	p-value	Q-Value	df(Q)	p-value
Fixed	12	0.652	[0.451;0.613]	16.120	0.000	243.154	11	0.00
Random	12	0.878	[0.569;0.872]	7.764	0.000			

Figure 3 Heterogeneity test results based on random effect model

Based on Figure 3, the effect size value of the entire study has a very significant effect. Furthermore, the p-value <0.05 or 0.00 <0.05 means that the random effect model is better than the fixed effect models. Thus, this study used a random effect model to perform data analysis. The hypothesis test based on the random effect model in Table 3 the application of the ethnoscience-based SETS learning model significantly affects learning physics and biology compared to conventional learning. The next step was to determine the publication bias of each study. The publication bias test used the results of the funnel plot diagram in Figure 4.

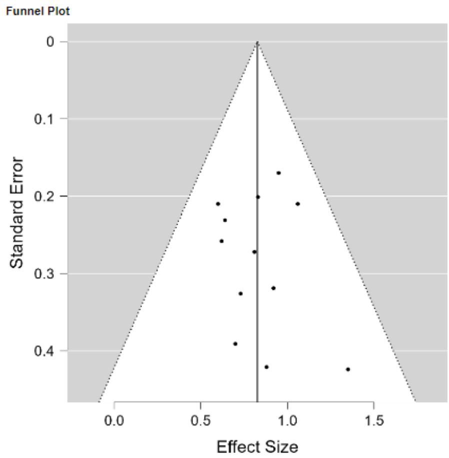

Figure 4 Funnel plots

The funnel plot diagram shows that the effect size distribution is not completely symmetrical, so it is necessary to do the FSN test. The results of the FSN test using the FSN application with the help of the JSAP application obtained 322. Furthermore, it is entered in the formula FSN = n / (5k + 10) or 322 (5.12 + 10) = 4.6 > 1. This result explains that the analyzed study is not prone to publication bias, then continued with the Trim and Fill test, which can be seen in Table 3.

Table 3 Publication bias test results with Trim and Fill

	Random Effect Size				
	Omitted studies	**Point Estimate**	**Lower Limit**	**Upper limit**	**Q-value**
Observed Value	2	0.687	0.310	1.801	72.145
Adjusted Value		0.480	0.270	1.290	165.901

Table 3 shows that the value of the trim and Fill test results explains the adjusted effect size value of 0.480 and the adjusted effect size value of 0.687. In addition, two studies must be eliminated in the data analysis. In the next stage, the characteristics of the education level, sample size, and year of publication are examined to determine the effectiveness of the SETS learning model in science learning. The analysis results based on the characteristics can be seen in Figure 5.

Study Charateristics	Group	Number Studies	Hedge's g	Test of Null (2tail)		Heterogenity		
				Z	P	Between Classes Effect (Q)	df (Q)	P
EducationStage	SD	3	0.760	3.870	0.000	1.916	1	0.120
	SMP	5	0.815	6.091	0.000			
	SMA	6	0.720	2.172	0.000			
Sample size	< 25 student	7	1.709	7.810	0.004	3.098	2	0.018
	>25 student	8	1.451	9.162	0.001			
Publication Year	2010-2017	2	0.751	3.510	0.000	0.417	1	0.031
	2018-2023	2	0.613	4.612	0.000			

Figure 5 Results of analysis of characteristics by study

Table 5 shows that the Z-test value of the three characteristics is less than 0.05. These results explain that applying the ethnoscience-based Science Environment Technology Society (SETS) learning model is more effective than conventional learning models. Therefore, the SETS learning model positively impacts learning physics and biology.

The application of the ethnoscience-based Science Environment Technology Society (SETS) learning model provides a significant effect on science learning. The results can be seen from the average effect size value (ES = 873) with large criteria. This STES learning model can improve students' critical thinking skills and knowledge in physics and biology (Amanda et al., 2018; Widiantini et al., 2017). Research results by Tiyanto et al. (2013) stated that the ethnoscience-based Science Environment Technology Society (SETS) learning model can improve student competence in learning. SETS learning also encourages students to improve science learning achievement at school (Aprianingtyas & Sumadi, 2016; Irma et al., 2021; Nurhayati et al., 2021; Nurtamam et al., 2023)

Trihastuti et al. (2017) stated that the application of the SETS learning model is very effective in improving students' science literacy skills in learning physics and biology students. Learning requires students to have high science literacy in order to solve phenomena in life (Ozer et al., 2021; Kristiyanto et al., 2020; Kapici, 2022). Therefore, the application of the SETS learning model helps students in higher-order thinking in science learning (Cinar et al., 2021), thus helping students to be more active in learning (Witdiya et al., 2023; Suryono et al., 2023).

The SETS learning model encourages students to have more fun learning because they interact directly with the community environment (Sari et al., 2022). In addition, this SETS learning model helps students learn directly by applying learning materials to the surrounding environment (Voulvoulis & Burgman, 2019; Celik & Bayrakçeken, 2016). The ethnoscience-based SETS learning model encourages students to be more innovative and creative in linking learning materials with technology. Research results by Pratitis (2015) show that the SETS learning model can improve the mastery of concepts and technology in science learning at school. Thus, this SETS model helps teachers be more creative in conducting science learning activities.

Professional teachers must be more able to adapt learning models that help the rest think scientifically in science learning. The ethnoscience-based Science Environment Technology Society (SETS) model helps students improve their science process skills in learning science (Nugraheni et al., 2013; Watiet al., 2022). Science process skills are very important for students to solve problems in learning (Oktarina et al., 2021; Suharyat et al., 2022). Sudarmin et al. (2020) stated that ethnoscience-based learning will make it easier for students to apply the subject matter to their local wisdom. Learning that connects ethnoscience will increase students' knowledge of the surrounding nature (Idrus, 2022; Mahendrani & Sudarmin, 2015; Sudarmin et al., 2018; Apra et al., 2021).

Teaching and learning activities by applying SETS will make it easier for students to understand and apply science subject matter. Science learning requires students to think critically and creatively and have problem-solving skills (Damayanti et al., 2017; Wahyu et al., 2020; Agussuryani et al., 2021). Therefore, the ethnoscience-based SETS learning model is very important to be applied in learning physics and biology students.

Ethnoscience-based biology and physics learning helps students more easily understand concepts and subject matter (Rahman et al., 2023; Arfianawati et al., 2016). The ethnoscience-based SETS model creates an interesting learning atmosphere in biology and physics. This is because ethnoscience-based learning makes it easier for students to learn their local wisdom (Rosyidah et al., 2013; Hastuti et al., 2017; Savitri & Sudarmin, 2016). As a result, the ethnoscience-based SETS model is very effective in encouraging students' critical thinking skills in biology and physics materials.

CONCLUSION

From the results of this study, it can be concluded that the average effect size value of all studies related to the effect of the ethnoscience-based SETS learning model in science learning is ES = 0.873 large criteria. These findings explain that the ethnoscience-based Science Environment Technology Society (SETS) model significantly affects learning physics and biology. Furthermore, this SETS learning model helps students to be more active and creative in learning physics and biology. Therefore, the ethnoscience-based SETS learning model has a major positive impact on learning physics and biology.

These results are very important in evaluating the implementation of the school learning system. Furthermore, this ethnoscience-based SETS model must be applied in learning biology and physics to stimulate students to think critically.

REFERENCES

Adiwiguna, P. S., Dantes, N., & Gunamantha, I. M. (2019). Pengaruh Model problem based learning (PBL) berorientasi stem terhadap kemampuan berpikir kritis dan literasi sains siswa kelas v sd di gugus i gusti ketut pudja. *Jurnal Pendidikan Dasar Indonesia*, *3*(2), 94–103.

Affilia, R., Komariyah, L., & Efwinda, S. (2023). Critical thinking skills improvement of students through guided inquiry learning model with scientific approach. *Jurnal Ilmiah Pendidikan Fisika*, *7*(1), 91. https://doi.org/10.20527/jipf.v7i1.6255

Agussuryani, Q., Sudarmin, S., & Sumarni, W. (2021). STEM integrated ethnoscience-based vocational school science teaching materials in improving student’s HOTs. *Berkala Ilmiah Pendidikan Fisika*, *9*(2), 185. https://doi.org/10.20527/bipf.v9i2.10431

Akdag, E., & Köksal, M. S. (2022). Investigating the relationship of gifted students’ perceptions regarding science learning environment and motivation for science learning with their intellectual risk taking and science achievement. *Science Education International*, *33*(1), 5–17. https://doi.org/10.33828/sei.v33.i1.1

Amanda, S., Muharrami, L. K., Rosidi, I., & Ahied, M. (2018). Peningkatan kemampuan berpikir kritis siswa pada pembelajaran ipa menggunakan model pembelajaran berbasis masalah yang berbasis sets. *Natural Science Education Research*, *1*(1), 57–64. https://doi.org/10.21107/nser.v1i1.4199

Anjelina, P. A. A., Swatra, I. W., & Tegeh, I. M. (2018). Pengaruh Model pembelajaran pbl berbantuan media gambar terhadap hasil belajar ipa siswa kelas iii sd. *Journal for Lesson and Learning Studies*, *23*(1), 21–32. https://doi.org/10.23887/mi.v23i1.16407

Aprianingtyas M, & Sumadi. (2016). Pengaruh model pembelajaran SETS (Science, Environment, Technology, and Society) terhadap prestasi belajar fisika. *Jurnal Ilmiah Pendidikan Fisika-COMPTON*, *3*(2), 1–8.

Aydede, M. N. (2022). Examining the primary school teacher candidates' science learning skills in terms of their attitudes towards science and their science teaching self-efficacy beliefs. *International Journal of Educational Methodology*, *8*(4), 853–864. https://doi.org/10.12973/ijem.8.4.853

Bantaokul, P., & Polyiem, T. (2022). The use of integrated 5Es of inquiring-based learning and gamification to improve grade 8 student science learning achievement. *Journal of Educational Issues*, *8*(1), 459. https://doi.org/10.5296/jei.v8i1.19802

Bayharti, B., Azumar, O. R., Andromeda, A., & Yerimadesi, Y. (2019). Effectiveness of redox and electrochemical cell module based guided discovery learning on critical thinking skills and student learning outcomes of high school. *Journal of Physics: Conference Series*, *1317*(1). https://doi.org/10.1088/1742-6596/1317/1/012144

Celik, S., & Bayrakçeken, S. (2016). The effect of a 'science, technology and society' course on prospective teachers' conceptions of the nature of science. *Research in Science and Technological Education*, *24*(2), 255–273. https://doi.org/10.1080/02635140600811692

Çınar, S., & Çepni, S. (2021). The impact of science teaching based on science-technology-society (STS) approach to elementary school students. *Educational Policy Analysis and Strategic Research*, *16*(4), 198–217. https://doi.org/10.29329/epasr.2021.383.11

Damayanti, C., Rusilowati, A., & Linuwih, S. (2017). Pengembangan model pembelajaran ipa terintegrasi etnosains. *Journal of Innovative Science Education*, *6*(1), 116–128.

Elfira, I., & Santosa, T. A. (2023). Literature study : Utilization of the pjbl model in science education to improve creativity and critical thinking skills. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 133–143. https://doi.org/10.29303/jppipa.v9i1.2555

Erna, N. S. S. (2016). Penerapan pendekatan jas (jelajah alam sekitar) pada mata kuliah konservasi dan kearifan lokal untuk menanamkan softskill konservasi pada mahasiswa ipa unnes. *Unnes Science Education Journal*, *5*(1), 1109–1115.

Fitri, L. S., Rosyida, F., Putra, A. K., Wirahayu, Y. A., & Selviana, N. (2022). The effect of geographical inquiry learning using SETS approach to complex problem-solving abilities on environmental conservation material. *Pegem Egitim ve Ogretim Dergisi*, *12*(4), 61–69. https://doi.org/10.47750/pegegog.12.04.07

Hastuti, P. W., Setianingsih, W., Sudarmin, S., Selia, E., & Taufiq, M. (2017). Identification of indigenous science in the brick- making process through ethnoscience study Identification of indigenous science in the brick-making process through ethnoscience study. *IOP Conf. Series: Journal of Physics: Conf. Series*, *983*, 1–6.

Ichsan, I., Yayat, S., & Tomi, A. S. E. (2023). The effectiveness of STEM-Based learning in teaching 21 st century skills in generation z student in science learning. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 150–166. https://doi.org/10.29303/jppipa.v9i1.2517

Idrus, S. W. Al. (2022). Implementasi STEM terintegrasi etnosains (Etno-STEM) di Indonesia: Tinjauan meta analisis. *Jurnal Ilmiah Profesi Pendidikan*, *7*(4), 2370–2376. https://doi.org/10.29303/jipp.v7i4.879

Irma, I., Meriyati, M., & Irwandani, I. (2021). Model pembelajaran discovery based unity of science (DBUS) dengan pendekatan SETS: Pengaruh terhadap kemampuan berpikir kritis pada masa pandemi covid-19. *U-Teach: Journal Education of Young Physics Teacher*, *2*(1), 29–35. https://doi.org/10.30599/uteach.v2i1.36

Jufrida, J., Basuki, F. R., Kurniawan, W., Pangestu, M. D., & Fitaloka, O. (2019). Scientific literacy and science learning achievement at junior high school. *International Journal of Evaluation and Research in Education*, *8*(4), 630–636. https://doi.org/10.11591/ijere.v8i4.20312

Kapici. (2022). Investigating the effects of different laboratory environments on gifted students' conceptual knowledge and science process skills. *Turkish Journal of Education*, *11*(2), 126–142.

Kristiana, T. F., & Radia, E. H. (2021). Meta analisis penerapan model problem based learning dalam meningkatkan hasil belajar ipa siswa sekolah dasar. *Jurnal Basicedu*, *5*(2), 818–826. https://doi.org/10.31004/basicedu.v5i2.828

Kristiyanto, W., Gunarhadi, & Indriayu, M. (2020). The effect of the science technology society and the quantum teaching models on learning outcomes of students in the natural science course in relation with their critical thinking skills. *International Online Journal of Education and Teaching*, *7*(1), 177–191.

Lin, T. J. (2021). Multi-dimensional explorations into the relationships between high school students' science learning self-efficacy and engagement. *International Journal of Science Education*, *43*(8), 1193–1207. https://doi.org/10.1080/09500693.2021.1904523

Lorás Hávard. (2020). sports The effects of physical education on motor competence in children and adolescents. *Sport*, *8*, 1–14.

Mahendrani, K., & Sudarmin, S. (2015). Pengembangan booklet etnosains fotografi tema ekosistem untuk meningkatkan hasil belajar pada siswa smp. *Unnes Science Education Journal*, *4*(2), 2015.

Nugraheni, D., Mulyani, S., & Ariani, S. R. D. (2013). Pengaruh pembelajaran bervisi dan berpendekatan SETS terhadap prestasi belajar ditinjau dari kemampuan berpikir kritis siswa kelas x sman 2 sukoharjo pada materi minyak bumi tahun pelajaran 2011/2012. *Jurnal Pendidikan Kimia*, *2*(3), 34–41.

Nurhayati, E., Andayani, Y., & Hakim, A. (2021). Pengembangan e-modul kimia berbasis STEM DENGAN PENDEKATAN ETNOSAINS. *Chemistry Education Practice*, *4*(2), 106–112. https://doi.org/10.29303/cep.v4i2.2768

Nuril, H. T. A. P. (2022). Efektivitas pembelajaran science environment technology and society pada materi sistem kardiovaskular di tingkat sarjana. *JBP : Jurnal Biologi Dan Pembelajarannya*, *9*(1), 55–61.

Nurtamam, M. E., Santosa, T. A., Aprilisia, S., Rahman, A., & Suharyat, Y. (2023). Meta-analysis :

The effectiveness of iot-based flipped learning to improve students ' problem solving abilities. *Edumaspul :Jurnal Pendidikan*, *7*(1), 1491–1501.

Nuryadin, A., Sulaeman, N. F., & Subagiyo, L. (2022). Developing worksheets using engineering design process to promote sustainable development goals for pre-service physics teacher. *Jurnal Ilmiah Pendidikan Fisika*, *7*(1), 182–192.

Oktarina, K., Suhaimi, S., Santosa, T. A., & ... (2021). Meta-analysis: The effectiveness of using blended learning on multiple intelligences and student character education during the covid-19 period. *Journal of Education*, *4*(3), 184–192. http://journal.ummat.ac.id/index.php/IJECA/article/view/5505%0Ahttps://journal.ummat.ac.id/index.php/IJECA/article/download/5505/pdf

Ozer, S., Kiray, S. A., & Cardak, O. (2021). Science teacher candidates' views about science-technology-society-environment relations. *Eurasian Journal of Educational Research*, *2021*(91), 83–104. https://doi.org/10.14689/ejer.2021.91.5

Pratitis, I. (2015). Penerapan model pembelajaran advance organizer bervisi sets terhadap peningkatan penguasaan konsep kimia. *Jurnal Inovasi Pendidikan Kimia*, *8*(2), 1370–1379.

Rahman, A., Suharyat, Y., Ilwandri, I., Santosa, T. A., Sofianora, A., Gunawan, R. G., & Putra, R. (2023). Meta-analisis: Pengaruh pendekatan STEM berbasis etnosains terhadap kemampuan pemecahan masalah dan berpikir kreatif siswa. *INNOVATIVE: Journal Of Social Science Research*, *3*(2), 2111-2125.

Ramani, S. (2022). Background and skill set of instructional designers questioned in the opm-university business model. *International Journal of Teaching and Learning in Higher Education*, *34*(1), 25–35.

Rosyidah, A. N., Sudarmin, K. S. (2013). Pengembangan modul ipa berbasis etnosains zat aditif dalam bahan makanan untuk kelas viii smp negeri 1 pegandon kendal. *Unnes Science Education Journal*, *2*(1), 133–139.

Rusilowati, A., Supriyadi, Binadja, A., & Mulyani, S. (2012). Mitigasi bencana alam berbasis pembelajaran bervisi science environment technology and society. *Jurnal Pendidikan Fisika Indonesia*, *8*(1), 51–60.

Said, E. Y. F., & Yerimadesi, Y. (2021). Efektivitas modul kesetimbangan kimia berbasis guided discovery learning terhadap hasil belajar peserta didik. *Edukimia*, *3*(1), 004–008. https://doi.org/10.24036/ekj.v3.i1.a154

Santosa, T. A., Razak, A., Arsih, F., & Sepriyani, E. M. (2021). Meta-analysis : Science learning based on local wisdom against preserving school environments during the covid-19 pandemic. *Journal of Biology Education*, *10*(2), 244–251.

Sari, E., Ramadansur, R., Putri, R. M., Awal, R., & Sari, M. (2022). Pengaruh penerapan model sets (science, environment, technology, society) melalui media obs (open broadcaster software) studio pada pembelajaran ekosistem terhadap hasil belajar siswa kelas x sman 16 pekanbaru. *Bio-Lectura : Jurnal Pendidikan Biologi*, *9*(2), 210–217. https://doi.org/10.31849/bl.v9i2.11533

Sary, L. L., Djumhana, N., & Hendriani, A. (2019). Pengaruh pembelajaran sets terhadap keterampilan proses sains siswa kelas v sekolah dasar. *Jurnal Pendidikan Guru Sekolah Dasar*, *4*(3), 194–207.

Siti Arfianawati, Sudarmin, dan W. S.

(2016). Model pembelajaran kimia berbasis etnosains untuk meningkatkan kemampuan berpikir kritis siswa. *Jurnal Pengajaran MIPA*, *21*(1), 46–51.

Suci, N. K. A. A., Pudjawan, K., & Parmiti, D. P. (2020). Pengaruh model pembelajaran core berbasis sets terhadap hasil belajar ipa siswa kelas v sd. *Mimbar Pendidikan Indonesia (MPI)*, *1*(3), 297–308. https://ejournal.undiksha.ac.id/index.php/JIPI2/article/view/30956/17316

Sudarmin, S., Selia, E., & Taufiq, M. (2018). The effect of inquiry learning model on additives theme with ethnoscience content to cultural awareness of students. *Journal of Physics: Conference Series*, *983*(1). https://doi.org/10.1088/1742-6596/983/1/012170

Sudarmin, S., Tri Prasetya, A., Diliarosta, S., Pujiastuti, R. S. E., & Jumini, S. (2020). The design of ethnoscience-based inquiry learning for scientific explanation about taxus sumatrana as cancer medication. *Journal for the Education of Gifted Young Scientists*, *8*(4), 1493–1507. https://doi.org/10.17478/jegys.792830

Suendarti, M., & Virgana, V. (2022). Elevating natural science learning achievement: Cooperative learning and learning interest. *Journal of Education and Learning (EduLearn)*, *16*(1), 114–120. https://doi.org/10.11591/edulearn.v16i1.20419

Suh, Y. J., Hong, H., Ohana, M., Bompard, F., Revel, M. P., Valle, C., Gervaise, A., Poissy, J., Susen, S., Hékimian, G., Artifoni, M., Periard, D., Contou, D., Delaloye, J., Sanchez, B., Fang, C., Garzillo, G., Robbie, H., & Yoon, S. H. (2021). Pulmonary embolism and deep vein thrombosis in covid-19: A systematic review and meta-analysis. *Radiology*, *298*(2), E70–E80. https://doi.org/10.1148/RADIOL.2020203557

Suhaimi, S., Santosa, T. A., & Aprilisia, S. (2022). Analisis pendekatan saintifik dalam pembelajaran ipa selama pandemi covid-19 di sekolah dasar. *Jurnal Didika: Wahana Ilmiah Pendidikan Dasar*, *8*(1), 92–101.

Suharyat, Y., Santosa, T. A., & Satria, E. (2023). The effectiveness of STEM-based learning in teaching 21 st century skills in generation z student in science learning. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 160–166. https://doi.org/10.29303/jppipa.v9i1.2517

Suharyat, Y., Supriyadi, A., Ichsan, I., Satria, E., & Santosa, T. A. (2022). Analisis pembelajaran daring dalam pembelajaran ipa di sma/ma di indonesia pasca pandemi covid-19: sebuah literatur reviews. *Jurnal Pendidikan dan Konseling (JPDK)*, *4*(5), 1860-1865.

Supriyadi, A., Suharyat, Y., Santosa, T. A., & Sofianora, A. (2023). The effectiveness of STEM-Integrated blended learning on indonesia student scientific literacy : A Meta-analysis. *International Journal of Education and Literature (IJEL)*, *2*(1), 41–48.

Suryono, W., Haryanto, B. B., Santosa, T. A., Suharyat, Y., & Sappaile, B. I. (2023). The effect of the blended learning model on student critical thinking skill : Meta-analysis. *Edumaspul-Jurnal Pendidikan*, *7*(1), 1386–1397.

Tiyanto, W., Binadja, A., & Santoso, N. (2013). Pengaruh model pembelajaran kumon berbantuan media poster bervisi SETS terhadap pencapaian kompetensi. *Chemistry in Education*, *2*(1), 8–14.

Trihastuti, Y., Rosana, D., & Anjarsari, P. (2017). Pengaruh penerapan model Sets (Science, Environment, Technology, And Society) terhadap literasi sains siswa kelas vii smp. *E-Journal Prodi*, *3*, 1–6.

Usmeldi, Amini, R., & Trisna, S. (2017). The development of research-based learning model with science, environment, technology, and society approaches to improve critical thinking of students. *Jurnal Pendidikan IPA Indonesia*, *6*(2), 318–325. https://doi.org/10.15294/jpii.v6i2.10680

Utami, N. M. S., & Astawan, I. G. (2020). Meta-analisis pengaruh model problem based learning terhadap hasil belajar ipa siswa sekolah dasar. *Jurnal Pedagogo Dan Pembelajaran*, *3*(3), 416–427.

Van Gobel, S. I., Rumape, O., & Duengo, S. (2019). Pengaruh model pembelajaran inkuiri terbimbing bervisi sets terhadap keterampilan proses sains dan hasil belajar pada materi larutan elektrolit dan nonelektrolit kelas x sma negeri 1 gorontalo. *Jambura Journal of Educational Chemistry*, *1*(1), 21–30. https://doi.org/10.34312/jjec.v1i1.2069

Voulvoulis, N., & Burgman, M. A. (2019). The contrasting roles of science and technology in environmental challenges. *Critical Reviews in Environmental Science and Technology*, *49*(12), 1079–1106. https://doi.org/10.1080/10643389.2019.1565519

Wahyu, Y., Edu, A. L., & Nardi, M. (2020). Problematika pemanfaatan media pembelajaran ipa di sekolah dasar. *Jurnal Penelitian Pendidikan IPA*, *6*(1), 107. https://doi.org/10.29303/jppipa.v6i1.344

Wati, W. W., Asrizal, A., & Usmeldi, U. (2022). Analisis effect size pengaruh pembelajaran ipa berbasis sets terhadap kemampuan proses sains dan hasil belajar peserta didik. *Jurnal IPA & Pembelajaran IPA*, *6*(1), 54–69. https://doi.org/10.24815/jipi.v6i1.23894

Widiana et al. (2022). Pengaruh model problem based learning (pbl) terhadap kemampuan literasi sains siswa. *SCIENING : Science Learning Journal*, *3*(1), 14–21. https://doi.org/10.53682/slj.v3i1.1076

Widiantini, N. N. A. S., Putra, M., & Wiarta, I. W. (2017). Model pembelajaran sets (science, environment, technology, society) berbantuan virtual lab berpengaruh terhadap kompetensi pengetahuan ipa. *Journal of Education Technology*, *1*(2), 141. https://doi.org/10.23887/jet.v1i2.11776

Witdiya, T., Supriadi, G., Supriatin, A., & Annovasho, J. (2023). The effect of steam learning on improving each indicator of students' creative thinking in physics learning. *Jurnal Ilmiah Pendidikan Fisika*, *7*(1), 42. https://doi.org/10.20527/jipf.v7i1.7158

Wong, S. Y., Liang, J. C., & Tsai, C. C. (2021). Uncovering malaysian secondary school students' academic hardiness in science, conceptions of learning science, and science learning self-efficacy: a Structural equation modelling analysis. *Research in Science Education*, *51*, 537–564. https://doi.org/10.1007/s11165-019-09908-7

Yakob, M., Hamdani, H., Sari, R. P., Haji, A. G., & Nahadi, N. (2021). Implementation of performance assessment in stem-based science learning to improve students' habits of mind. *International Journal of Evaluation and Research in Education*, *10*(2), 624–631. https://doi.org/10.11591/ijere.v10i2.21084

Yuniastuti, E. (2015). Pengaruh model

pembelajaran sets (science, environment, technology and society) terhadap hasil belajar biologi siswa kelas vii smp kartika v-1 balikpapan tahun pelajaran 2015/2016. *JST (Jurnal Sains Terapan)*, *1*(2), 72–78. https://doi.org/10.32487/jst.v1i2.94

Zahra, M., Wati, W., & Makbuloh, D. (2019). Pembelajaran SETS (Science, Environment, Technology, Society): Pengaruhnya pada keterampilan proses sains. *Indonesian Journal of Science and Mathematics Education*, *2*(3), 320–327. https://doi.org/10.24042/ijsme.v2i3.4357

Zorlu, Y., & Zorlu, F. (2021). Investigation of the relationship between preservice science teachers' 21st century skills and Science learning self-efficacy beliefs with structural equation model. *Journal of Turkish Science Education*, *18*(1), 1–16. https://doi.org/10.36681/tused.2021.49

Zulkifli, Z., Agus, S., Erwinsyah, S., & Tomi, A. S. (2022). Meta-analysis: The effectiveness of the integrated stem technology pedagogical content knowledge learning model on the 21st century skills of high school students in the science department. *Psychology, Evaluation, and Technology in Educational Research*, *1*(2), 68–76. https://doi.org/10.55606/ijel.v1i2.32

Zulyusri, Z. Tomi, A. S., Festiyed, F., Yerimadesi, Y., Yohandri, Y., & Abdul, R. S. (2023). Effectiveness of stem learning based on design thiking in improving critical thinking skills in science learning. *Jurnal Penelitian Pendidikan IPA*, *9*(6), 112–119. https://doi.org/10.29303/jppipa.v9i6.3709