e-ISSN: 2721-1274
p-ISSN:2721-2718

META-ANALYSIS OF *EFFECT SIZE*: THE EFFECT OF USING ETHNOSCIENCE-BASED SCIENCE AND PHYSICS TEACHING MATERIALS ON STUDENTS' SCIENCE LITERACY

Halimah Tusa'diah[1], Asrizal[2], Festiyed[2]
Master of Physics Education Study Program, FMIPA, Padang State University[1,2]
halimahtusadiah25575@gmail.com

ABSTRACT

This study examines the effect of teaching materials in ethnoscience-based science and physics learning on students' scientific literacy, determined through Effect Size (ES). This study uses a descriptive meta-analysis study method. Research data were obtained from 20 journals on the effect of ethnoscience-based physics and science teaching materials on students' scientific literacy. The study is based on three categories, namely the level of education, types of teaching materials and scientific literacy skills. The results showed that; first, the effect of teaching materials in ethnoscience-based science and physics learning on scientific literacy based on education level has a positive effect on all levels of education starting from elementary, junior high, high school and college students. Second, based on the type of teaching materials used, namely modules, worksheets, videos, teaching materials, reading books and comics, they have a high effect. Third, based on the scientific literacy of students, it shows that the use of ethnoscience-based science and physics teaching materials is effective in increasing students' scientific literacy.

Keywords: Meta Analysis, Teaching Materials, scientific literacy

INTRODUCTION

The 21st century is characterized by the rapid development of science and technology in the field of life in society, especially information and communication technology. The development of science and technology affects various aspects of life from the economic, political, social, cultural aspects including the field of education. Education is very important in dealing with the development of science and technology. Learning in the 21st century must be contextual, related to community life, student-centered and collaborative, education graduates must have good competencies to compete in the 21st century (Asrizal, Amran, Ananda, & Festiyed, 2018). Quality human resources are an important factor in development in the era of globalization that prioritizes science and technology. This shows that the generation needed today is a generation that is able to compete and compete in the 21st century. Various efforts have been made by the government to change the education system in Indonesia to face the 21st century. One of them is the change in the learning curriculum (Mukminan, 2014).

The current curriculum in Indonesia is the 2013 curriculum. The 2013 curriculum learning system centers learning on students, teachers only function as facilitators, these learning activities make students more active in learning. In addition to demanding students to be more active, it is expected that students can use or apply their knowledge in solving problems, making decisions, evaluating problems, and participating in real life. Conceptually, learning activities must be

e-ISSN: 2721-1274
p-ISSN:2721-2718

close to the environment. Learning activities should optimally utilize the potential of the environment so that learning is more meaningful but in reality this has not always been done by teachers. Teachers need to recognize and preserve culture in life (Wardani et al.2013). Classroom learning should lead students to be literate about science and technology. One of the dimensions in learning science is that science learning is intended to obtain a relationship between science and technology and society (Chiapetta & Koballa, 2010).

Measurement of science literacy skills is conducted by the *Program for International Student assessment* (PISA). The results of the PISA test in 2012 showed that the science literacy skills of students in Indonesia were still at the lowest position, ranking 64 out of 65 countries. Indonesia obtained a total science competency score of 382 from an average score of 501 (OECD, 2012). The results of the 2015 PISA test and evaluation of Indonesian students' mastery of the material are also still relatively low. The achievement score of Indonesian students for science is ranked 62 with a score of 403 out of 70 countries evaluated (PISA, 2015). The results of the 2018 PISA study showed that for the science category, Indonesia was ranked 71st in the 9th rank from the bottom with an average score of 396. The third real condition is that there are still many (48%) students who have not completed learning physics and the activeness of students is still low (Usmeldi. 2016). This proves that the science literacy skills of Indonesian students are still relatively low, but can still be improved with various efforts, one of which is by learning science that leads students to be literate about science and technology and in learning also needs to contribute to the surrounding environment (*Local wisdom*), so that students can also think scientifically about phenomena in the surrounding environment. Based on the description, the right approach is ethnoscience-based learning.

Ethnoscience is a system of knowledge and cognition (ideas / thoughts) unique to a particular culture. Learning with an ethnoscience approach emphasizes achieving an integrated understanding rather than just a deep understanding. learners learn to connect the material learned in class with the context of their lives and the link between science and technology. so that learning at school is not only informative but also practical and useful in life. One of the dimensions in learning science is that science learning is intended to obtain a relationship between science and technology and society (Chiapetta & Koballa, 2010).

Teaching materials are designed as tools that can help educators and students in the learning process so that learning is more effective (Asrizal et al., 2018). This research was conducted with several objectives. The first is to see how much influence is given by ethnoscience physics and science teaching materials on science literacy based on the level of education. The second is based on the type of teaching materials and the third is based on science literacy.

METHODS

This study uses a meta-analysis research method by reviewing several articles in national and international journals. Data were obtained from journals relevant to the research, namely journals regarding the effect of using physics and science teaching materials on students' science literacy. after searching, 20 journals

e-ISSN: 2721-1274
p-ISSN:2721-2718

were found in accordance with this research and the data information in them could be processed.

To determine the magnitude of the effect size can be determined, in statistical parameters as presented in table 1. After obtaining the *Effect Size* (ES), the results can be interpreted according to predetermined criteria if ES (0 < ES < 0.2), then it is categorized as low. If ES (0.2 < ES < 0.8), it is categorized as moderate. If (ES> 0.8) then it is categorized as high.

Table 1: How to determine the magnitude of *Effect Size*

No.	Statistical Data	Formula	Formula
.	Average in one group	$ES = \frac{\bar{X}_{post} - \bar{X}_{pre}}{SD_{pre}}$	Fr-1
.	Average in each group (*two groups posttest only*)	$ES = \frac{\bar{X}_E - \bar{X}_C}{SD_C}$	Fr-2
.	Mean of each group (*two groups pre-post tests*)	$ES = \frac{(\bar{X}_{post} - \bar{X}_{pre})_E - (\bar{X}_{post} - $ $\frac{SD_{preC} + SD_{preE} + SD_{po}}{3}$	Fr-3
.	Chi-Square	$ES = \frac{2r}{\sqrt{1-r^2}}; \sqrt{\frac{\chi^2}{n}}$	Fr-4
.	t count	$ES = t\sqrt{\frac{1}{n_E} + \frac{1}{n_C}}$	Fr-5
.	P-value	CMA (*Comperhensive Meta Analysis Software*)	Fr-6

RESULT & DISCUSSION

This study was conducted to see the effect of using ethnoscience-based physics and science teaching materials on students' science literacy by reviewing and analyzing several moderator variables. Data were obtained from journals that

e-ISSN: 2721-1274
p-ISSN:2721-2718

are relevant to this research and support the calculation of the *effect size of* each journal. The selected articles are 20 international and national articles and are coded J1 to J20. Table 2 contains the codes, sources and *effect sizes* that have been analyzed from the 20 journals.

.

Table 2: Journal code, source, *effect size* and formula

Journal Code	Journal Source	*Effect Size*	Formula
J1	**(Nihwan & Widodo, 2020)**	**1.8**	**Fr-5**
J2	**(Perwitasari et al., 2017)**	**4.4**	**Fr-1**
J3	**(Pursitasari et al., 2019)**	**1.93**	**Fr-5**
J4	**(Masfufah & Ellianawati, 2020)**	**1.31**	**Fr-5**
J5	**(Ariningtyas et al., 2017)**	**0.8**	**Fr-5**
J6	**(Nisaâ et al., 2015)**	**3.8**	**Fr-5**
J7	**(Wibowo & Ariyatun, 2020)**	**0.8**	**Fr-5**
J8	**(Putri et al., 2020)**	**0.12**	**Fr-5**
J9	**(Alim et al., 2019)**	**1.31**	**Fr-5**
J10	**(Kriswanti & Supardi, 2020)**	**0.9**	**Fr-5**
J11	**(Nadhifatuzzahro, 2019)**	**2.4**	**Fr-5**
J12	**(Setiawan et al., 2017)**	**0.6**	**Fr-1**
J13	**(Septiani & Listiyani, 2021)**	**2.3**	**Fr-5**
J14	**(Lubis et al., 2021)**	**2.61**	**Fr-5**
J15	**(Hadi et al., 2020)**	**3,04**	**Fr-2**
J16	**(Sanova et al., 2021)**	**2,71**	**Fr-5**
J17	**(Nilamsari, 2021)**	**0,73**	**Fr-5**
J18	**(Fiteriani et al., 2021)**	**0.8**	**Fr-1**
J19	**(Mardianti et al., 2020)**	**1.2**	**Fr-5**
J20	**(ZAHRO & Widodo, 2019)**	**2.5**	**Fr-5**

The Effect of Using Ethnoscience-Based Physics and Science Teaching Materials on Science Literacy Based on Education Levels

The first result in this study is related to the effect size analysis of the effect of using ethnoscience-based physics and science teaching materials on science literacy in terms of education level. The calculations obtained are presented in Table 3.

Table 3: *Effect Size of* Ethnoscience-Based Teaching Materials Based on Education Levels

Education Level	Journal Code	*Effect Size*	Average Securities Size	Category
SD	J9	1.31	1.03	High
	J10	0.9		
	J18	0.8		
SMP	J1	1.8	2.32	High
	J2	4.4		
	J3	1.93		
	J4	1.31		

e-ISSN: 2721-1274
p-ISSN:2721-2718

	J6	3.8		
	J11	2.4		
	J12	0.6		
	J14	2.61		
	J15	3,04		
	J19	1.2		
	J20	2.5		
HIGH SCHOOL	J5	0.8	1.26	High
	J7	0.8		
	J16	2,71		
	J17	0,73		
STUDENTS	J8	2.3	1.21	High
	J13	0.12		

From the calculation of *Effect Size, the effect of* using Ethnoscience-based physics and science teaching materials on students' science literacy based on the level of education, obtained ES = 1.03 with a high effect size category for elementary school level; ES = 2.32 with a high effect size category for junior high school level; ES = 1.26 with a high effect size category for senior high school level and ES = 1.21 with a high effect size category for university students.

Analysis based on the level of education found that the use of ethnoscience-based physics and science teaching materials is effective in junior high school compared to elementary and high school and university students. However, all three levels of elementary, junior high and high school education have an Effect Size with a high category. This shows that ethnoscience-based teaching materials are very effective at all levels of education in learning science and physics.

The effect of using ethnoscience-based physics and science teaching materials on science literacy in terms of the type of teaching materials.

The second result in this study is related to the effect size analysis of the use of ethnoscience-based physics and science teaching materials on science literacy in terms of the type of teaching materials. The calculations obtained are presented in Table 4.

Table 4: Effect Size of Ethnoscience-Based Teaching Materials on Science Literacy Based on Type of Teaching Materials

Types of Teaching Materials	**Journal Code**	**Effect Size**	**Average Securities Size**	**Category**
Module	J1	1.8	2.05	High
	J6	3.8		
	J12	0.6		
	J13	2.3		
	J14	2.61		
	J19	1.2		
LKPD	J4	1.31	1.10	High

e-ISSN: 2721-1274
p-ISSN:2721-2718

	J5	0.8		
	J8	0.12		
	J10	0.9		
	J11	2.4		
Video	J7	0.8	1.83	High
	J15	3,04		
	J16	2,71		
	J18	0.8		
Teaching Materials	J2	4.4	2.54	High
	J3	1.93		
	J9	1.31		
Reading Book	J17	0,73	0.73	Medium
Comics	J20	2.5	2.5	High

From the calculation of *Effect Size, the effect* size of the use of ethnoscience-based physics and science teaching materials on science literacy based on the type of teaching materials, obtained ES = 2.05 with a high effect *size* category for module teaching materials; ES = 1.10 with a high effect size category for LKS / LKPD teaching materials; ES = 1.83 with a high effect size category for video teaching materials; ES = 2.54 with a high effect size category for teaching materials; ES = 0.73 with a medium effect size category for reading book teaching materials; and ES = 2.5 with a high effect size category for comic teaching materials.

The effect of using ethnoscience-based physics and science teaching materials in terms of students' science literacy skills

The third result in this study is related to the *effect size* analysis of the use of ethnoscience-based physics and science teaching materials in terms of students' science literacy skills. The calculations obtained are presented in Table 5.

Table 5: Effect Size of Ethnoscience-Based Teaching Materials in terms of students' science literacy skills

Ability	**Journal Code**	**Effect Size**	**Average Securities Size**	**Category**
Science Literacy	J1	1.8	1.80	High
	J2	4.4		
	J3	1.93		
	J4	1.31		
	J5	0.8		
	J6	3.		

e-ISSN: 2721-1274
p-ISSN:2721-2718

	8	
J7		0.
	8	
J8		0.
	12	
J9		1.
	31	
J10		0.
	9	
J11		2.
	4	
J12		0.
	6	
J13		2.
	3	
J14		2.
	61	
J15		3.
	04	
J16		2.
	71	
J17		0.
	73	
J18		0.
	8	
J19		1.
	2	
J20		2.
	5	

From the calculation of *Effect Size, the effect* size of the use of ethnoscience-based physics and science teaching materials on literacy in terms of students' science literacy skills, obtained ES = 1.80 with a high *effect size* category. This shows that ethnoscience-based physics and science teaching materials are very effective in improving students' science literacy.

Effect Size is an important component in metaanalysis. *Effect Size* indicates the magnitude of the effect of a treatment relationship between two variables. Effect *Size* can present information from the summary results of the analyzed journals. By determining the effect *size of* each study, the overall average *effect size* can be determined. Researchers calculated the *Effect Size* price with Cohen's formula. The results of this study were carried out in three categories, namely the effect of ethnoscience-based physics and science teaching materials on science literacy based on education level (elementary, junior high and high school), the effect of ethnoscience-based physics and science teaching materials on science literacy based on the type of teaching materials (modules, LKPD, videos, teaching materials, reading books and comics), and the effect of ethnoscience-based physics and science

e-ISSN: 2721-1274
p-ISSN:2721-2718

teaching materials on science literacy based on students' science literacy skills.

The results of this study indicate that the use of ethnoscience-based physics and science teaching materials on students' science literacy. The first result achieved is ethnoscience-based physics and science teaching materials on science literacy based on the level of education provides a high effect on elementary, junior high and high school education levels. This means that at each level of education, ethnoscience-based teaching materials influence the science literacy of students.

The second result achieved is the effect of ethnoscience-based physics and science teaching materials on students' science literacy in terms of the type of teaching materials consisting of 6 types of teaching materials, namely modules, LKPD, videos, teaching materials, reading books and comics. From the results of the calculation, the effect of ethnoscience-based physics and science teaching materials on the science literacy of students on each teaching material has a high effect.

The third result achieved is the effect of ethnoscience-based physics and science teaching materials on students' science literacy in terms of students' science literacy skills. From the calculation results, the effect of ethnoscience-based physics and science teaching materials on students' science literacy on each teaching material has a high effect.

Overall, ethnoscience-based physics and science teaching materials have a high positive effect on students' science literacy. This shows that ethnoscience-based physics and science teaching materials are effective for use at all levels of education and are well used with various types of teaching materials, and are effective in improving students' scientific literacy.

CONCLUSION

Based on the data that has been stated in this study, three results of this study can be stated. First, the influence of ethnoscience-based physics and science teaching materials in terms of elementary, junior high, high school, and college students education levels provides a high influence and is effectively used at all levels of education. Second, the effect of ethnoscience-based physics and science teaching materials in terms of the type of teaching materials has a high influence and is effectively used in learning and third, the effect of ethnoscience-based physics and science teaching materials in terms of science literacy skills has a high influence and is effective in improving students' science literacy.

The limitations of this study only use 20 national and international journals. Future research needs to increase the number of journals analyzed.

BIBLIOGRAPHY

ı, A., Sarwi, S., & Subali, B. (2019). Implementation Of Ethnoscience-Based Guided Inquiry Learning On The Scientific Literacy And The Character Of Elementary School Students. *Journal of Primary Education*, *8*(5), 139-147.

ingtyas, A., Wardani, S., & Mahatmanti, W. (2017). Effectiveness of Student Worksheet with Ethnoscience Content on Salt Hydrolysis to Improve Science Literacy of Senior High School Students. *Journal of Innovative Science Education*,

e-ISSN: 2721-1274
p-ISSN:2721-2718

6(2), 186-196.

zal, A., Amran, A., Ananda, A., & Festiyed, F. (2018, April). Effectiveness Of Adaptive Contextual Learning Model Of Integrated Science By Integrating Digital Age Literacy On Grade Viii Students. In Iop Conference Series: Materials Science And Engineering (Vol. 335, No. 1, P. 012067). Iop Publishing.

iani, I., Ningsih, N. K., Irwandani, I., Santi, K., & Romlah, R. (2021). Poster Media with an Ethnoscience Approach: Development of Science Teaching Materials for Elementary School Students. *Indonesian Journal of Science Education*, *9*(4), 540-554.

i, W. P., Munawaroh, F., Rosidi, I., & Wardani, W. K. (2020). Application of Discovery Learning Model with Ethnoscience Approach to Identify Science Literacy Profile of Junior High School Students. *Jipi (Journal of Science & Learning)*, *4*(2), 178-192.

vanti, D. P., & Supardi, Z. A. I. (2020). Development of Ethnoscience-Based Learning Tools to Train Elementary School Learners' Science Literacy. *Journal of Education And Development*, *8*(3), 372-372.

s, M. F., Sunarto, A., & Walid, A. (2021). Development of Ethnoscience-Based Science Learning Modules on Global Warming Materials to Train Science Literacy Skills of Junior High School Students. *Paedagoria: Journal of Educational Studies, Research and Development*, *12*(2), 206-214.

dianti, I., Kasmantoni, K., & Walid, A. (2020). Development of Ethnoscience-Based Science Learning Module on Environmental Pollution Material to Train Science Literacy of Class Vii Students in Smp. *Bio-Edu: Journal of Biology Education*, *5*(2), 97-106.

fufah, F. H., & Ellianawati, E. (2020). Improving students' science literacy through ethnoscience-infused Contextual Teaching and Learning (Ctl) approach. *Upej Unnes Physics Education Journal*, *9*(2), 129-138.

hifatuzzahro, D. (2019). Feasibility of Ethnoscience-Based Student Activity Sheets (Lks) on the Theme of Herbs to Train Students' Science Literacy. *Pensa E-Journal: Science Education*, *7*(2).

van, M. T., & Widodo, W. (2020). Application of Ethnoscience-Based Science Module to Improve Science Literacy Skills of Junior High School Students. *Pensa: E-Journal of Science Education*, *8*(3), 288-298.

msari, R. (2021). Development of Ethnoscience-Based Chemistry Reading Book on Menginang Tradition as a Source of Science Literacy. *Journal Of Tropical Chemistry Research And Education*, *3*(2), 74-84.

â, A., Sudarmin, S., & Samini, S. (2015). Effectiveness of Using Ethnoscience Integrated Module in Problem-Based Learning to Improve Students' Science Literacy. *Unnes Science Education Journal*, *4*(3).

itasari, T., Sudarmin, S., & Linuwih, S. (2017). Improving Science Literacy Through Ethnoscience-Charged Learning of Energy and Its Changes in Fish Smoking. *Journal of Science Education Research*, *1*(2), 62-70.

itasari, I. D., Suhardi, E., Ardianto, D., & Arif, A. (2019). Development of Teaching Materials with Marine Context to Improve Students' Science Literacy. *Journal of Science & Science Learning*, *3*(2), 88-105.

i, D. P., Febianti, Y. N., & Muslimin, S. (2020). Developing Teaching Materials Based on Cirebon Local Genius as an Effort to Build Student Science Literacy. *Pedagogia: Journal of Education*, *9*(1), 109-124.

e-ISSN: 2721-1274
p-ISSN:2721-2718

ıva, A., Afrida, A., Bakar, A., & Yuniarccih, H. R. (2021). Ethnoscience Approach through Problem Based Learning Model on Chemical Literacy in Buffer Solution Material. *Zarah Journal*, *9*(2), 105-110.

iani, D., & Listiyani, L. R. (2021). Ethnoscience Module Innovation: Traditional Herbal Medicine as Cultured Learning and Science Literacy. *Educative: Journal of Education Science*, *3*(2), 288-297.

wan, B., Innatesari, D. K., Sabtiawan, W. B., & Sudarmin, S. (2017). The Development Of Local Wisdom-Based Natural Science Module To Improve Science Literacy Of Students. *Journal of Indonesian Science Education*, *6*(1).

eldi (2016). Development of Research-Based Physics Learning Modules with a Scientific Approach to Improve Learners' Science Literacy.JPPPF - Journal of Physics Education Research & Development p-ISSN: 2461-0933 | e-ISSN: 2461-1433.

ɔwo, T., & Ariyatun, A. (2020). Science Literacy Skills in Senior High School Students Using Ethnoscience-Based Chemistry Learning. *Edusains*, *12*(2), 214-222.

'o, T., & Widodo, W. (2019). Implementation of Learning Using Ethnoscience-Based Comics on Mixed Separation Materials to Train Students' Science Literacy Skills. *Pensa: E-Journal of Science Education*, *7*(2).