



# European Journal of Educational Research

Volume 12, Issue 2, 1071 - 1084.

ISSN: 2165-8714

<http://www.eu-jer.com/>


## Relationship Between Knowledge and Affection for the Environment: A Meta-Analysis

Trias Hernanda\* 

Muhammadiyah University of Kudus,  
INDONESIA

Absori 

Muhammadiyah University of Surakarta,  
INDONESIA

Aidul Fitriadi Azhari 

Muhammadiyah University of Surakarta,  
INDONESIA

Kelik Wardiono 

Muhammadiyah University of Surakarta, INDONESIA

Janu Arlinwibowo 

Risetin, INDONESIA

Received: September 14, 2022 • Revised: January 25, 2023 • Accepted: March 13, 2023

**Abstract:** Environmental damage must be taken seriously. Strengthening human attitudes to preserve the environment is the keyword, and strengthening the aspects of knowledge about the environment must be pursued. However, a scientific basis is needed that shows that it is true that strengthening the aspects of knowledge about the environment can improve a person's attitude toward preserving the environment. The purpose of this research is to find the relationship between a person's knowledge and their behavior in preserving the environment. By defining the general picture of the relationship between knowledge and attitudes, future accurate educational policies can be taken in the context of environmental protection. This research is a meta-analysis of correlation types. The inclusion criteria for selecting the data are as follows: studies published from 1999 to 2022 in English, analyzed by correlation analysis, have descriptions of many samples and correlation indices, and published in Google Scholar-indexed journals. Based on this inclusion criteria, 23 studies were selected containing 36 relevant sets of research data. The results showed that there was a correlation between knowledge and a person's attitude toward the environment (.37). Assuming a 95% confidence level, the real score ranges from 0.26 to 0.48. The publication bias test using the trim and fill method showed that none of the data contained biased publications, so the meta-analysis results could be declared valid. Now, there is an urgency to expand environmental education to encourage the development of good attitudes by the community toward the environment.

**Keywords:** *Affection, conservation, environment, knowledge, meta-analysis.*

**To cite this article:** Hernanda, T., Absori, Azhari, A. F., Wardiono, K., & Arlinwibowo, J. (2023). Relationship between knowledge and affection for the environment: A meta-analysis. *European Journal of Educational Research*, 12(2), 1071-1084. <https://doi.org/10.12973/eu-jer.12.2.1069>

### Introduction

The issue of environmental damage has been discussed worldwide for a long time as evidenced by the world-class conference held in 1972 in Stockholm, Sweden, with the theme of environmental damage (Jordan & O'Riordan, 2003). Most large western countries realized that environmental protection is important and merits ongoing attention. The facts confirm that fears about environmental damage have now been proven, namely climate change (Myers & Patz, 2009), deforestation (Tsujino et al., 2016), river pollution (Blettler et al., 2019), marine pollution (Haward, 2018), and decreased air quality. These problems are affecting all countries.

The main actor causing environmental damage is humans. Uncontrolled human population growth has resulted in a surge in human needs and activities. Unfortunately, this is not balanced with a good understanding of environmental protection. As a result, humans are victims of environmental damage. Efforts are being made to save the environment. For example, the concept of sustainable development established by the United Nations has been approved by 192 countries. They have agreed on 17 targets that have the ultimate goal of protecting the environment and humans (Gigliotti et al., 2019).

Education plays a very important role related to environmental issues, as it can be used as a medium to foster people's love for the environment (Hamalosmanoglua, 2012). Education is also one of the easiest ways to help save the environment. Educational pathways can be used to build awareness of environmental protection (Faize & Akhtar, 2020), and this can be done through various formal and informal channels.

\* **Corresponding author:**

Trias Hernanda, Muhammadiyah University of Kudus, Indonesia. ✉ [triashernanda@umkudus.ac.id](mailto:triashernanda@umkudus.ac.id)

Building an understanding of environmental protection requires effort and a method that is constantly changing because it follows the development of environmental problems. This allows the education pathway to have the opportunity to contribute to increasing the awareness of environmental protection. Education can help people form a pro-environmental attitude. This attitude has a positive impact on the environment by encouraging people to learn about environmental protection.

Behaviors and attitudes are parts of affection and can be explained by a feeling of wanting to be better or worse. Likewise, with pro-environmental attitudes that arise because there is a sense of wanting to improve a bad living environment into a good living environment, the first step is to change attitudes and behaviors (Bhanthumnavin & Bhanthumnavin, 2014).

Affection is a warm, tender feeling of caring for or loving something (Pal, 2017). Affection is manifested by human attitudes and behavior towards something. Attitude is a pro-environmental attitude that involves actions to minimize negative effects or increase positive effects on the environment (Bleidorn et al., 2021) Behavior is any active response to current environmental problems, which is believed to be pro-environmental by those who respond (Eilam & Trop, 2012). Thus, the terms environmental attitudes and behaviors are the original terms that represent environmental affection.

Several meta-analytic articles discuss attitudes toward the environment (Mifsud, 2012) conducted a study on global youth environmental knowledge, attitude, and behavior studies. This research concluded that most students have good attitudes and behaviors. Another meta-analytic study by (van de Wetering et al., 2022) shows that schools have a positive impact on knowledge, attitude, and behavior. However, these two meta-studies did not identify a relationship between knowledge and other variables. In contrast, research by (Whitburn et al., 2020) concluded that the closer a person is to nature, the more pro-environmental they will be. Research conducted by (Allum et al., 2008) stated that there is a positive relationship between scientific knowledge and cross-cultural attitudes. Thus, this research found something new about the relationship between knowledge and one's affection.

Conducting studies regarding the relationship between knowledge and affection is crucial because it can become the basis for making policies. If it has a positive relationship, educational institutions can reinforce knowledge about the environment, and the government can provide socialization to strengthen that knowledge more intensively. The need for the results of this analysis in decision-making is deemed critical to anticipate environmental damage by a growing human population.

The purpose of this research is to find the relationship between a person's knowledge and their behavior in preserving the environment. By defining the general picture of the relationship between knowledge and attitudes, future accurate educational policies can be taken in the context of environmental protection.

### Methodology

This research used a correlation type meta-analysis method to conclude from various results that the same theme was carried out by multiple researchers. Meta-analysis makes global inferences related to studies conducted by previous researchers. This research model collects quantitative data and analyzes it with statistics so that it can be concluded globally. The theme of this research is the relationship between knowledge and the environment with a person's behavior in the environment. We know that, currently, there are various institutions that encourage increasing insights and strengthening cognitive aspects to improve the quality of human behaviors towards the environment. The hope is that with cognitive strengthening, there will be an increase in the quality of one's behavior in the surrounding environment.

The data in this study are the results of research conducted by previous researchers related to the relationship between cognitive aspects of a person's behavior toward the environment. In determining the data, there are inclusion criteria in Table 1.

*Table 1. Aspects and Criteria of Collecting Data*

Aspect	Inclusion	Exclusion	Information
Time	From 1999 to 2022	Else	The time span of the article (research data) published
Language	English	Else	The language used in the article
Data Type	Quantitative	Else	Types of data in research
Data	Contains an r (reliability index) and an n (sample size)	Does not contain an r (reliability index) or an n (sample size)	Articles must contain correlation index data and sample size as material for finding effect sizes and standard errors
Theme	Correlation of cognitive aspects with one's behavior in an effort to preserve the environment	Else	Specification of the theme considered in data collection

Table 1. Continued

Aspect	Inclusion	Exclusion	Information
Analysis Data	Correlation	Else	Analytical procedures used to analyze and conclude data
Journal Index	Google Scholar, Scopus, WoS, EBSCO, DOAJ	Else	Indexing agency as a minimum quality standard in journals as a place of publication of articles

In addition to the inclusion criteria in determining the data, there were exclusion criteria outside the six inclusion criteria. In other words, articles that did not meet the six inclusion criteria were included in the category of articles that met the exclusion criteria. This means that the groups of articles with the exclusion criteria were not included in the analysis.

From the data collection process, 48 articles were obtained regarding the relationship between cognition and one's behavior toward the preservation of the environment. However, only 23 articles met the inclusion criteria and were analyzed, while the remaining 25 articles were excluded.

In these 23 articles, several contained research with complex themes so that they had more than one study that could be analyzed. An example is the research conducted by Alias (2019) that analyzed two types of data: knowledge with attitude and knowledge with behavior. Another example is research conducted by Makki et al. (2003) that, in one study, provided three different types of data: knowledge with attitude, knowledge with behavior, and knowledge with total attitude. As a final total, we analyzed 36 sets of data sourced from the 23 selected articles.

This research used a random effects model that aimed to produce conclusions that have generalizability. To analyze the data using the random effects model, it was necessary to prove heterogeneity. The heterogeneity criteria can be seen in the value of  $I^2$ . The data were said to be heterogeneous if  $I^2 > 25\%$  (Arlinwibowo et al., 2022).

The type of meta-analysis in this study is a correlation that showed a general description of the relationship between a person's cognition and behavior toward the environment. The following is a sequence of analyzes to find the effect size and standard error of the correlation type in the meta-analysis. Correlation index ( $r$ ) is the effect size, but in the meta-analysis, it needs to be transformed using the Fisher transformation procedure (Retnawati, Apino et al., 2018) into  $z$  with the following formula. The calculation of effect size and standard error used JASP software to draw the forest plot and final plot.

This research was carried out with a proportional role between researchers. The first researcher has the task of managing the team and determining the direction of the research. The data collection process refers to the inclusion and exclusion criteria. The first researcher has the task of collecting data simultaneously, then the fifth researcher acts as a verifier and enters data in the analysis table. The fifth researcher analyzed according to a meta-analysis-specific protocol. The results of the analysis were translated by the second researcher and elaborated with various literature by the third and fourth researchers. The results of the analysis and interpretation were compiled into a research report by the first researcher.

### Findings

An environment is a place that provides all the needs of living beings. Therefore, the environment needs sustainability, and that sustainability can be pursued without sacrificing future generations (Mota & Scott, 2014). One way that can support environmental sustainability is to cultivate an attitude of love for the environment. In the process of cultivating this love is the cultivation of knowledge about the urgency of environmental conservation. The search produced various results that correlated knowledge with a person's attitude toward protecting their environment.

Based on the correlation index ( $r$ ) and the number of samples in the study ( $n$ ), the effect size ( $z$ ) and standard error (SE $z$ ) were found. The total effect size and standard error data for each research are shown in Table 2.

Table 2. Summary of Data, Effect Size, and Standard Error

No	Researcher	n	r	z	SEz
1	(Aminrad et al., 2013)_1	470	0,174	0,176	0,046
2	(Aminrad et al., 2013)_2	470	0,165	0,167	0,046
3	(Minchekar, 2020)	100	0,448	0,482	0,102
4	(Spínola, 2020)_1	486	0,198	0,201	0,046
5	(Spínola, 2020)_2	474	0,224	0,228	0,046
6	(Bradley et al., 1999)	217	-0,27	-0,277	0,068
7	(Maleki & Karimzadeh, 2011)	383	0,097	0,097	0,051
8	(Birhanu, 2014)_1	286	0,447	0,481	0,059
	(Birhanu, 2014)_2				

Table 2. Continued

No	Researcher	n	r	z	SEz
9		286	0,417	0,444	0,059
10	(Itasanmi & Jegede, 2019)	403	0,588	0,675	0,050
11	(Varoglu et al., 2018)_1	145	0,46	0,497	0,084
12	(Varoglu et al., 2018)_2	145	0,21	0,213	0,084
13	(Alias, 2019)_1	150	0,451	0,486	0,082
14	(Alias, 2019)_2	150	0,401	0,425	0,082
15	(Abdul-Halim et al., 2021)_1	128	0,532	0,593	0,089
16	(Abdul-Halim et al., 2021)_2	128	0,574	0,653	0,089
17	(Kuppusamy & Mari, 2017)	234	0,815	1,142	0,066
18	(Mihanpour et al., 2018)_1	404	0,323	0,335	0,050
19	(Mihanpour et al., 2018)_2	404	0,292	0,301	0,050
20	(Ahmad et al., 2015)	854	0,217	0,221	0,034
21	(Mohiuddin et al., 2018)_1	200	0,803	1,107	0,071
22	(Mohiuddin et al., 2018)_2	200	0,875	1,354	0,071
23	(Bashirun & Noranee, 2020)	108	-0,114	-0,114	0,098
24	(de Pauw & van Petegem, 2011)	1287	0,159	0,160	0,028
25	(Kuhlemeier et al., 1999)_1	9000	0,44	0,472	0,011
26	(Kuhlemeier et al., 1999)_2	9000	0,36	0,377	0,011
27	(Janmaimool & Khajohnmanee, 2019)	278	0,24	0,245	0,060
28	(Tamar et al., 2021)_1	285	0,35	0,365	0,060
29	(Tamar et al., 2021)_2	285	0,02	0,020	0,060
30	(Wulandari et al., 2021)_1	272	0,00	0,000	0,061
31	(Wulandari et al., 2021)_2	272	0,02	0,020	0,061
32	(Esa, 2010)_1	115	0,561	0,634	0,094
33	(Esa, 2010)_2	115	0,263	0,269	0,094
34	(Makki et al., 2003)_1	660	0,22	0,224	0,039
35	(Makki et al., 2003)_2	660	0,33	0,343	0,039
36	(Makki et al., 2003)_3	660	0,3	0,310	0,039

Note: n is the number of respondents for each study, r is the correlation index, z is the effect size, and SEz is the standard error.

Before the correlation type meta-analysis, the process that will be carried out is to prove the homogeneity of the data. The estimation used is the heterogeneity test with parameter  $I^2$ . The results of the heterogeneity test with parameter  $I^2$  are shown in Table 3.

Table 3. Residual Heterogeneity Estimates

Estimate	
$I^2$ (%)	98.572

The results in Table 2 show that  $I^2 = 98,572 > 25\%$  and indicate that the index is close to the value of 100%. These results indicate that the effect size between studies is heterogeneous. Thus, the test using random effects can be continued.

Then, the results of the analysis will be analyzed based on the distribution of data in the forest plot. A forest plot, also known as a blobbogram, is a visualization of effect size and standard error for each study. This visualization shows the trend of the data so that it helps us in seeing the global conclusions of the many pieces of research analyzed. The following is a forest plot of the relationship between a person's knowledge and attitude toward the environment.

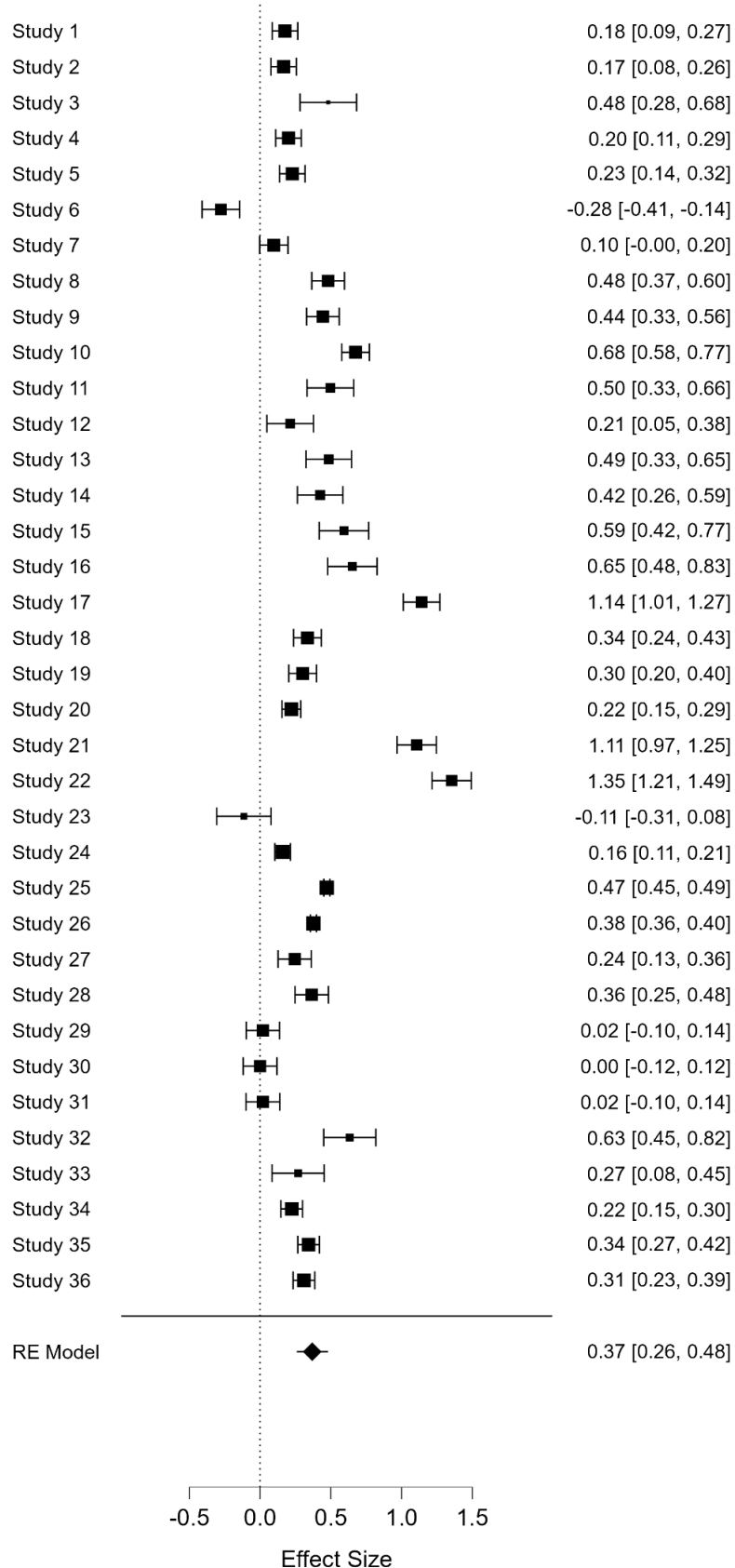


Figure 1. Forest Plot

The forest plot shows that the distribution of data is very diverse. There are research results that show a negative correlation, a low correlation, or a very strong correlation. All research results produced a conclusion effect of 0.37. This effect shows that, in general, the correlation of one's knowledge of the environment with behavior in preserving the environment is 0.37. Assuming a 95% confidence level, it is known that the value of 0.37 is the visible score and the real score ranges from 0.26 to 0.48. Thus, it can be concluded that there is a relationship, although not strong, between

one's knowledge of the environment and one's behavior in preserving the environment. In other words, the more you understand the environment, the better your attitude towards the environment will be. Based on these results, education and socialization related to the environment needs to be sought so that the condition of the surrounding environment is maintained and remains sustainable.

However, in conducting a meta-analysis, researchers need to confirm the data bias. Detection of this bias can be done with the trim and fill method that uses an iterative procedure that aims to remove various small data or large errors in the funnel plot and recalculate the effect size so as to produce an adjusted effect size. Thus, researchers can detect changes or shifts in the effect size of research results that are not included in the analysis process. The following are the results of a funnel plot search to detect biased publications using the trim and fill method (Figure 2).

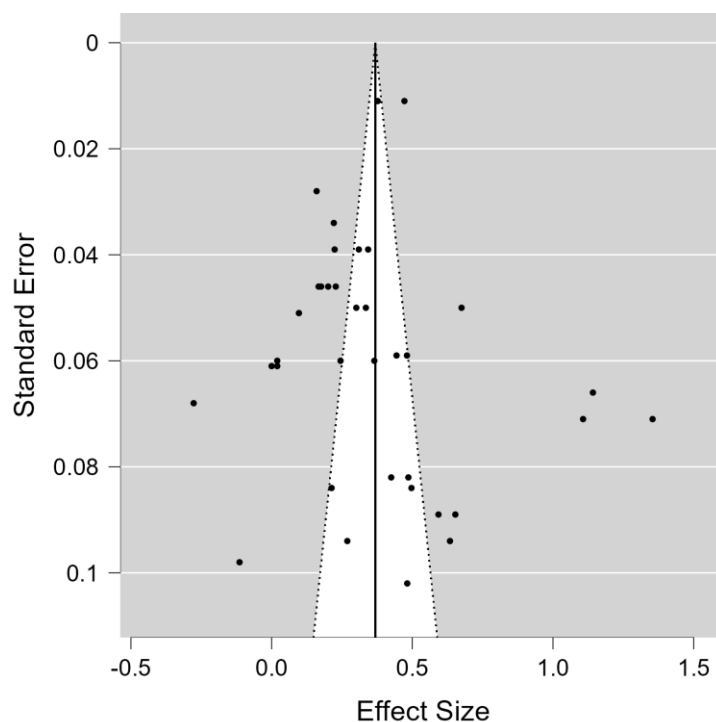


Figure 2. Funnel Plot Output of Trim and Fill Method

Based on the Funnel Plot in Figure 2, none of the points is open (all dots are black). Such conditions indicate that all studies included in the meta-analysis were published (none was omitted). This means that the conclusion that there is a correlation of one's knowledge is positively related by 0.37 with one's attitude toward environmental preservation, free from potential bias. To strengthen this conclusion, Figure 1 will be compared with the forest plot of the iteration of the trim and fill method. As a result, both forest plots show the exact same distribution. There is no difference in effect size or standard error, thus indicating that there is no shift in value. The results of the analysis strengthen the conclusion of the funnel plot visualization that the analyzed data are free from publication bias. Publication bias was also confirmed by the fail-safe N method which showed a value of 28512. This value indicated a fail-safe  $N > 5K + 10 = 190$ , so it could be concluded that there was no publication bias problem in this meta-analysis study.

Based on these tests, the conclusion that there is a correlation of 0.37 between a person's knowledge of the environment and their attitude toward environmental conservation is valid. The use of data sourced from various researchers, countries, and times shows that the data conclusions are generalized to different locations (general in nature). The statement certainly applies in normal circumstances and is not an anomaly.

### Discussion

Climate change and food security have recently become global topics (Kremsa, 2021). The discussion occurred because the world's environmental conditions were undergoing degradation that resulted in ecological damage (Shrinkhal, 2019). After that, a question arises about the continuation of human life in the future. Taking care of the environment is a very important but often overlooked action.

In addition to climate change and food security, several developing countries, such as Indonesia, Brazil, and Afghanistan, have also felt the effects of environmental damage, such as flash floods and damage to natural ecosystems (dos Santos et al., 2021; Jawid & Khadjavi, 2019; Tacconi et al., 2019). Protecting the environment from damage is a challenge for humans because, basically, human life depends on nature.

Environmental damage has a long-term impact. If it is already damaged, then restoring the natural function will take a long time. Environmental damage can also lead to conflict between countries. For example, forest fires on the islands of Kalimantan and Sumatra sent smoke to neighboring Malaysia, Brunei Darussalam, and Singapore (Kadir et al., 2021). This sparked protests from these three countries.

Love for the environment has a good impact on environmental security, taking into consideration that the environment is currently being threatened by some excessive activities by humans (Abdallah, 2017). These human activities have a negative impact, such as climate change (Hartter et al., 2018), reduced supply of clean water (Aldaya et al., 2021), and air pollution (Tainio et al., 2021). Increasing a sense of love for the environment can be started by learning about the function of the environment, studying biodiversity, and studying sustainable development. The next step that can be taken to foster a sense of love for the environment is to learn obedience to the regulations governing the environment.

In some countries, such as Indonesia, environmental problems arise due to the disobedience of the Indonesian people to the rules made to protect the environment (Hernanda & Giyono, 2021). The future of the environment is in human hands. Therefore, every human being must have an attitude of love for the environment to protect its future. Unfortunately, the attitude of love for the environment is not felt by every human being. So far, human orientation has only focused on economic growth and technological development. This focus arises due to the population explosion, where nature is exploited to meet human needs without thinking about the sustainability of the environment (O'Sullivan, 2020).

Human behavior that does not protect the environment results in environmental degradation and damage (Saari et al., 2021). One of the attitudes that does not reflect the attitude of protecting the environment is the consumption pattern of products that are unsustainable and difficult to recycle (Rees, 2020). These products impact environmental sustainability and interfere with the activities of other living things. In some of the world's oceans, such as the Indonesian ocean, non-recyclable waste (plastic food packaging and beverage bottles) is very easy to find (Purba et al., 2019). Concern for the environment is indeed influenced by the behavior of each individual, but the behavior of caring for the environment and sustainable consumption patterns can be built on scientific knowledge and education (Saari et al., 2021). The urgency of a pro-environmental attitude or an attitude of caring for the environment plays an important role in maintaining the future of the environment in several areas, such as rivers, oceans, forests, and air cleanliness. The importance of education in supporting environmental preservation has been frequently explained. One educational method that is useful for environmental sustainability is to encourage students to become smarter and schools will then produce human resources who can properly preserve the environment (Liu et al., 2020). Knowledge plays an important role in supporting changes in human attitudes to support energy saving (Gkargkavouzi et al., 2019).

In accordance with the curriculum mandate, education develops multi-dimensional abilities, namely attitudes, knowledge, and skills (Arlinwibowo et al., 2020a, 2020b, 2021; Retnawati et al., 2017). These three abilities must develop in a balanced way so that someone can become an independent, good person and contribute to society (Retnawati, Arlinwibowo et al., 2018). Education is expected to shape students' personalities (Zurqoni et al., 2018). The concept of learning is implemented through the transfer of information, conditioning, and absorption. Information that produces knowledge is expected to have an influence on a person's way of thinking and lifestyle (Retnawati et al., 2017). Thus, strengthening one's knowledge of environmental conservation needs to be carried out massively to increase people's love for the environment, which is reflected in the various attitudes, behaviors, and actions that protect the environment.

This research differs from other studies that examine the relationship between knowledge and love for the environment. This situation can be proven by a comparison of research with several previous studies, as explained by van de Wetering's research that states how education provides a good approach in terms of knowledge about the environment (van de Wetering et al., 2022). In addition, Varela-Candamio et al. (2018) states that education is the right way to develop behavior. Thus, research is needed that reveals the relationship between knowledge and love for the environment

### Conclusion

Meta-analysis shows that there is a positive correlation between a person's knowledge of the environment and their attitude in preserving the environment. The data in the forest plot show that the general correlation between a person's knowledge of the environment and their attitude toward preserving the environment is 0.37. Assuming a 95% confidence level, it is known that the value of 0.37 is the visible score and the real score ranges from 0.26 to 0.48. Although it is not included in the category of highly correlated, this fact shows a positive correlation that occurs under normal circumstances. These findings confirm that knowledge has a significant relationship to one's affection for the environment. These findings can be used as a basis related to the urgency of strengthening knowledge about the environment.

The publication bias test using the trim and fill method showed that none of the data indicated that it contained biased publications, so the results of the meta-analysis were valid. Thus, there is an urgency to advocate for environmentally conscious education to encourage the growth of good attitudes in society toward the environment.

### Recommendations

Understanding the importance of a clean-living environment requires various ways, including education. However, the knowledge and education about the environment must be adapted to the conditions of each region. This education aims to provide a simple example and adapt to the character of the student and the student's place of residence. For example, a student who lives in a watershed area is given an education about the watershed environment and learns not to pollute the river's flow with waste and how to keep the watershed safe from illegal garbage disposal. More in-depth research is needed related to learning strategies that can increase knowledge of the environment so that it can shape the character of students. This is important because school is a place to shape one's character from an early age.

### Limitations

Based on the results of the study, we convey that we cannot see case-by-case details regarding the relationship between education and environmental awareness because we used secondary data analysis. Thus, a more in-depth search is needed when implementing environmental education in each school.

### Acknowledgments

We would like to thank DRPM of the Directorate of Higher Education, Indonesian Ministry of Education for facilitating this research in the form of funding through the Beginner Lecturer Research (Penelitian Dosen Pemula/PDP) scheme.

### Authorship Contribution Statement

Trias: Collecting data simultaneously and Compiling analysis and interpretation into a research report, Janu: Acts as a verifier and enters data in the analysis table and analyzed according to a meta-analysis-specific protocol, Absori: Translating the results of the analysis, Kelik: Elaborated with various literature, Aidul: Elaborated with various literature.

### References

- Abdallah, T. (2017). *Sustainable mass transit: Challenges and opportunities in urban public transportation*. Elsevier. <https://doi.org/10.1016/B978-0-12-811299-1.00001-0>
- Abdul-Halim, N. S., Ruslan, N. S., Idris, N. S. U., & Nawawi, S. A. (2021). Knowledge, attitude and practice of environmental sustainability among sustainable science students in Universiti Malaysia Kelantan. *IOP Conference Series: Earth and Environmental Science*, 842, Article 012048. <https://doi.org/10.1088/1755-1315/842/1/012048>
- Ahmad, J., Md. Noor, S., & Ismail, N. (2015). Investigating students' environmental knowledge, attitude, practice and communication. *Asian Social Science*, 11(16), 284–293. <https://doi.org/10.5539/ass.v11n16p284>
- Aldaya, M. M., Sesma-Martín, D., & Rubio-Varas, M. (2021). Tracking water for human activities: From the ivory tower to the ground. *Water Resources and Economics*, 36, Article 100190. <https://doi.org/10.1016/j.wre.2021.100190>
- Alias, N. A. (2019). Correlation between knowledge, attitude, and behaviour towards river pollution. *International Journal of Modern Trends in Social Sciences*, 2(9), 31–38. <https://doi.org/10.35631/ijmtss.29004>
- Allum, N., Sturgis, P., Tabourazi, D., & Brunton-Smith, I. (2008). Science knowledge and attitudes across cultures: A meta-analysis. *Public Understanding of Science*, 17(1), 35–54. <https://doi.org/10.1177/0963662506070159>
- Aminrad, Z., Sayed Zakariya, S. Z. B., Samad Hadi, A., & Sakari, M. (2013). Relationship between awareness, knowledge and attitudes towards environmental education among secondary school students in Malaysia. *World Applied Sciences Journal*, 22(9), 1326–1333. [https://www.idosi.org/wasj/wasj22\(9\)13/15.pdf](https://www.idosi.org/wasj/wasj22(9)13/15.pdf)
- Arlinwibowo, J., Retnawati, H., & Kartowagiran, B. (2020a). Model penilaian capaian belajar matematika dengan framework STEM [Mathematics learning achievement assessment model in learning with the STEM framework]. UNY Press.
- Arlinwibowo, J., Retnawati, H., & Kartowagiran, B. (2020b). The types of STEM education implementation in Indonesia. *Journal of Xi'an University of Architecture & Technology*, XII(VIII), 606–613. <http://bit.ly/3zffBHS>
- Arlinwibowo, J., Retnawati, H., & Kartowagiran, B. (2021). How to integrate STEM education in the Indonesian curriculum? A systematic review. *Materials of International Practical Internet Conference "Challenges of Science", IV(2021)*, 18–25. <https://doi.org/10.31643/2021.03>
- Arlinwibowo, J., Retnawati, H., & Kartowagiran, B. (2022). The impact of ICT utilization to improve the learning outcome: A meta-analysis. *International Journal of Evaluation and Research in Education*, 11(2), 522–531. <https://doi.org/10.11591/ijere.v11i2.22112>
- Bashirun, S. N., & Noranee, S. (2020). Influence of environmental knowledge and attitude on employee green behaviour. *International Journal of Academic Research in Business and Social Sciences*, 10(6), 937–946.



<https://doi.org/10.6007/ijarbss/v10-i6/7463>

- Bhanthumnavin, D., & Bhanthumnavin, V. (2014). The empirical development of cognitive, affective, and behavioral tendency measures of attitudes toward nuclear power plants in Thai university students. *Progress in Nuclear Energy*, 73, 86–95. <https://doi.org/10.1016/j.pnucene.2013.12.013>
- Birhanu, A. (2014). Environmental knowledge, attitude and participatory behavior towards land degradation in injibara secondary and preparatory school, Northwestern Ethiopia. *Journal of Environment and Earth Science*, 4(17), 89–96. <https://bit.ly/3FZyRIn>
- Bleidorn, W., Lenhausen, M. R., & Hopwood, C. J. (2021). Proenvironmental attitudes predict proenvironmental consumer behaviors over time. *Journal of Environmental Psychology*, 76, Article 101627. <https://doi.org/10.1016/j.jenvp.2021.101627>
- Blettler, M. C. M., Garello, N., Ginon, L., Abrial, E., Espinola, L. A., & Wantzen, K. M. (2019). Massive plastic pollution in a mega-river of a developing country: Sediment deposition and ingestion by fish (*Prochilodus lineatus*). *Environmental Pollution*, 255(3), Article 113348. <https://doi.org/10.1016/j.envpol.2019.113348>
- Bradley, J. C., Waliczek, T. M., & Zajicek, J. M. (1999). Relationship between environmental knowledge and environmental attitude of high school students. *Journal of Environmental Education*, 30(3), 17–21. <https://doi.org/10.1080/00958969909601873>
- de Pauw, J. B., & van Petegem, P. (2011). The effect of Flemish eco-schools on student environmental knowledge, attitudes, and affect. *International Journal of Science Education*, 33(11), 1513–1538. <https://doi.org/10.1080/09500693.2010.540725>
- dos Santos, G. L., Pereira, M. G., Delgado, R. C., Magistrali, I. C., de Silva, C. G., Oliveira, C. M. M., Larangeira, J. P. B., & da Silva, T. P. (2021). Forest ecology and management degradation of the Brazilian Cerrado : Interactions with human disturbance and environmental variables. *Forest Ecology and Management*, 482, Article 118875. <https://doi.org/10.1016/j.foreco.2020.118875>
- Eilam, E., & Trop, T. (2012). Environmental attitudes and environmental behavior-which is the horse and which is the cart? *Sustainability*, 4(9), 2210–2246. <https://doi.org/10.3390/su4092210>
- Esa, N. (2010). Environmental knowledge, attitude and practices of student teachers. *International Research in Geographical and Environmental Education*, 19(1), 39–50. <https://doi.org/10.1080/10382040903545534>
- Faize, F. A., & Akhtar, M. (2020). Addressing environmental knowledge and environmental attitude in undergraduate students through scientific argumentation. *Journal of Cleaner Production*, 252, Article 119928. <https://doi.org/10.1016/j.jclepro.2019.119928>
- Gigliotti, M., Schmidt-Traub, G., & Bastianoni, S. (2019). The sustainable development goals. In B. Fath (Ed.), *Encyclopedia of Ecology* (2nd ed., pp. 426–431). Elsevier. <https://doi.org/10.1016/B978-0-12-409548-9.10986-8>
- Gkargkavouzi, A., Halkos, G., & Matsiori, S. (2019). How do motives and knowledge relate to intention to perform environmental behavior? Assessing the mediating role of constraints. *Ecological Economics*, 165, Article 106394. <https://doi.org/10.1016/j.ecolecon.2019.106394>
- Hamalosmanoglu, M. (2012). The place of environmental education in science education curricula in Turkey. *Procedia - Social and Behavioral Sciences*, 46, 4839–4844. <https://doi.org/10.1016/j.sbspro.2012.06.345>
- Hartter, J., Hamilton, L. C., Boag, A. E., Stevens, F. R., Ducey, M. J., Christoffersen, N. D., Oester, P. T., & Palace, M. W. (2018). Does it matter if people think climate change is human caused? *Climate Services*, 10, 53–62. <https://doi.org/10.1016/j.cliser.2017.06.014>
- Haward, M. (2018). Plastic pollution of the world 's seas and oceans as a contemporary challenge in ocean governance. *Nature Communications*, 9, Article 667. <https://doi.org/10.1038/s41467-018-03104-3>
- Hernanda, T., & Giyono, U. (2021). Environmental Legal Protection of Rivers in the Perspective of Sustainable Development. *Jurnal Jurisprudense*, 11(1), 100–113. <https://doi.org/10.23917/jurisprudense.v11i1.14744>
- Itasanmi, S. A., & Jegede, T. E. (2019). Investigation of market women's environmental knowledge, attitude and behaviour in Nigerian City of Ibadan. *International Journal of Education and Literacy Studies*, 7(4), 76–82. <https://doi.org/10.7575/aiac.ijels.v.7n.4p.76>
- Janmaimool, P., & Khajohnmanee, S. (2019). Roles of environmental system knowledge in promoting university students' environmental attitudes and pro-environmental behaviors. *Sustainability*, 11(16), Article 4270. <https://doi.org/10.3390/su11164270>
- Jawid, A., & Khadjavi, M. (2019). Adaptation to climate change in Afghanistan : Evidence on the impact of external interventions. *Economic Analysis and Policy*, 64, 64–82. <https://doi.org/10.1016/j.eap.2019.07.010>

- Jordan, A., & O'Riordan, T. (2003). Institutions for global environmental change. *Global Environmental Change*, 13(3), 223–228. [https://doi.org/10.1016/S0959-3780\(03\)00005-0](https://doi.org/10.1016/S0959-3780(03)00005-0)
- Kadir, E. A., Roza, S. L., Syukur, A., Othman, M., & Daud, H. (2021). Forest fire spreading and carbon concentration identification in tropical region Indonesia. *Alexandria Engineering Journal*, 61(2), 1551–1561. <https://doi.org/10.1016/j.aej.2021.06.064>
- Kremsa, V. Š. (2021). Sustainable management of agricultural resources (agricultural crops and animals). In J. V.-M. Chaudhery Hussain (Ed.), *Sustainable resource management modern approaches and contexts* (pp. 99–145). Elsevier Inc. <https://doi.org/10.1016/B978-0-12-824342-8.00010-9>
- Kuhlemeier, H., van den Bergh, H., & Lagerweij, N. (1999). Environmental knowledge, attitudes, and behavior in dutch secondary education. *Journal of Environmental Education*, 30(2), 4–14. <https://doi.org/10.1080/00958969909601864>
- Kuppusamy, S., & Mari, T. S. (2017). Relationship between environmental awareness and environmental knowledge using “AKASA” model among architecture students in private universities, Klang Valley, Malaysia. In *2nd International Conference on Knowledge Engineering and Applications, ICKEA 2017* (pp. 151–155). IEEE. <https://doi.org/10.1109/ICKEA.2017.8169920>
- Liu, P., Teng, M., & Han, C. (2020). Science of the Total Environment How does environmental knowledge translate into pro-environmental behaviors?: The mediating role of environmental attitudes and behavioral intentions. *Science of the Total Environment*, 728, Article 138126. <https://doi.org/10.1016/j.scitotenv.2020.138126>
- Makki, M. H., Abd-El-Khalick, F., & Boujaoude, S. (2003). Lebanese secondary school students' environmental knowledge and attitudes. *Environmental Education Research*, 9(1), 21–33. <https://doi.org/10.1080/13504620303468>
- Maleki, A., & Karimzadeh, S. (2011). A survey of relationship between the environmental attitudes and environmental knowledge and energy consumption behavior among citizens of Urmia, West Azerbaijan, Iran. *International Journal of Social Sciences and Humanity Studies*, 3(1), 27–37. <http://bit.ly/3G3RQ11>
- Mifsud, M. C. (2012). A meta-analysis of global youth environmental knowledge, attitude and behavior studies. *US-China Education Review B*, 3, 259–277.
- Mihanpour, H., Khashij, M., Shamsizadeh, Z., Gholami, M., Ebrahimi, A., Rezaeipandari, H., Malekahmadi, R., Arsham, A., Parizan, F., & Jafari, V. (2018). *Assessment of the awareness, attitude and environmental literacy about environmental issues and challenges (Case study: Yazd Citizen's View in 2017)*. Preprints. <https://doi.org/10.20944/preprints201811.0375.v1>
- Minchekar, V. S. (2020). Correlation between environmental knowledge and environmental attitude among highschool students. *Mukt Shabd Journal*, IX(IV), 2325-2334 . <https://zenodo.org/record/3961304>
- Mohiuddin, M., Al Mamun, A., Syed, F. A., Masud, M. M., & Su, Z. (2018). Environmental knowledge, awareness, and business school students' intentions to purchase green vehicles in emerging countries. *Sustainability*, 10(5), Article 1534. <https://doi.org/10.3390/su10051534>
- Mota, R., & Scott, D. (2014). *Education for innovation and independent learning*. Elsevier. <https://doi.org/10.1016/C2013-0-19177-5>
- Myers, S. S., & Patz, J. A. (2009). Emerging threats to human health from global environmental change. *Annual Review of Environment and Resources*, 34, 223–252. <https://doi.org/c8332r>
- O'Sullivan, J. N. (2020). The social and environmental influences of population growth rate and demographic pressure deserve greater attention in ecological economics. *Ecological Economics*, 172, Article 106648. <https://doi.org/10.1016/j.ecolecon.2020.106648>
- Pal, D. (2017). Of affection and indulgence. *International Educational Scientific Research Journal*, 3(10), 1–4. <https://bit.ly/3G7fdKq>
- Purba, N. P., Handyman, D. I. W., Pribadi, T. D., Syakti, A. D., Pranowo, W. S., Harvey, A., & Ihsan, Y. N. (2019). Marine debris in Indonesia: A review of research and status. *Marine Pollution Bulletin*, 146, 134–144. <https://doi.org/10.1016/j.marpolbul.2019.05.057>
- Rees, W. E. (2020). Ecological economics for humanity 's plague phase. *Ecological Economics*, 169, Article 106519. <https://doi.org/10.1016/j.ecolecon.2019.106519>
- Retnawati, H., Apino, E., Kartianom, Djidu, H., & Anazifa, R. D. (2018). *Pengantar analisis meta [Introduction to meta analysis]*. Parama Publishing.
- Retnawati, H., Arlinwibowo, J., Wulandari, N. F., & Pradani, R. G. (2018). Teachers' difficulties and strategies in physics

- teaching and learning that applying mathematics. *Journal of Baltic Science Education*, 17(1), 120–135. <https://doi.org/10.33225/jbse/18.17.120>
- Retnawati, H., Munadi, S., Arlinwibowo, J., Wulandari, N. F., & Sulistyaningsih, E. (2017). Teachers' difficulties in implementing thematic teaching and learning in elementary schools. *The New Educational Review*, 48, 201–212. <https://doi.org/10.15804/tner.2017.48.2.16>
- Saari, U. A., Damberg, S., Frömbing, L., & Ringle, C. M. (2021). Sustainable consumption behavior of Europeans : The influence of environmental knowledge and risk perception on environmental concern and behavioral intention. *Ecological Economics*, 189, 107155. <https://doi.org/10.1016/j.ecolecon.2021.107155>
- Shrinkhal, R. (2019). Economics, technology, and environmental protection: A critical analysis of phytomanagement. In K. B. Vimal Chandra Pandey (Ed.), *Phytomanagement of polluted sites market opportunities in sustainable phytoremediation* (pp. 569–580). Elsevier. <https://doi.org/10.1016/B978-0-12-813912-7.00022-3>
- Spínola, H. (2020). Correlation between environmental literacy components (knowledge, attitude, and behavior) in Madeira Island (Portugal) 9<sup>th</sup> grade students. *The Online Journal of New Horizons in Education*, 10(1), 28–36. <https://bit.ly/3LN8t8a>
- Tacconi, L., Rodrigues, R. J., & Maryudi, A. (2019). Law enforcement and deforestation: Lessons for Indonesia from Brazil. *Forest Policy and Economics*, 108, Article 101943. <https://doi.org/10.1016/j.forpol.2019.05.029>
- Tainio, M., Andersen, Z. J., Nieuwenhuijsen, M. J., Hu, L., de Nazelle, A., An, R., Garcia, L. M. T., Goenka, S., Zapata-Diomed, B., Bull, F., & de Sa, T. H. (2021). Air pollution , physical activity and health : A mapping review of the evidence. *Environment International*, 147, Article 105954. <https://doi.org/10.1016/j.envint.2020.105954>
- Tamar, M., Wirawan, H., Arfah, T., & Putri, R. P. S. (2021). Predicting pro-environmental behaviours: The role of environmental values, attitudes and knowledge. *Management of Environmental Quality: An International Journal*, 32(2), 328–343. <https://doi.org/10.1108/MEQ-12-2019-0264>
- Tsujino, R., Yumoto, T., Kitamura, S., Djamaluddin, I., & Darnaedi, D. (2016). History of forest loss and degradation in Indonesia. *Land Use Policy*, 57, 335–347. <https://doi.org/10.1016/j.landusepol.2016.05.034>
- van de Wetering, J., Leijten, P., Spitzer, J., & Thomaes, S. (2022). Does environmental education benefit environmental outcomes in children and adolescents? A meta-analysis. *Journal of Environmental Psychology*, 81, 101782. <https://doi.org/10.1016/j.jenvp.2022.101782>
- Varela-Candamio, L., Novo-corti, I., & García-álvarez, M. T. (2018). The importance of environmental education in the determinants of green behavior: A meta-analysis approach. *Journal of Cleaner Production*, 170, 1565–1578. <https://doi.org/10.1016/j.jclepro.2017.09.214>
- Varoglu, L., Temel, S., & Yilmaz, A. (2018). Knowledge, attitudes and behaviours towards the environmental issues: Case of Northern Cyprus. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(3), 997–1004. <https://doi.org/10.12973/ejmste/81153>
- Whitburn, J., Linklater, W., & Abrahamse, W. (2020). Meta-analysis of human connection to nature and roenvironmental behavior. *Conservation Biology*, 34(1), 180–193. <https://doi.org/10.1111/cobi.13381>
- Wulandari, I. A. I., Al Muhdhar, M. H. I., Mardiyanti, L., Triani, L., & Purwanti, W. C. (2021). The relationship between knowledge and attitude towards students' behaviour in environmental literacy. *AIP Conference Proceedings*, 2330(1), Article 030007. <https://doi.org/10.1063/5.0043110>
- Zurqoni, Retnawati, H., Arlinwibowo, J., & Apino, E. (2018). Strategy and implementation of character education in senior high schools and vocational high schools. *Journal of Social Studies Education Research*, 9(3), 370–397. <http://bit.ly/3lQaYMA>

## Appendix

No	Researcher	Title	Journal	Edition	Year	n	r	Variable
1	Zarrintaj Aminrad, Sharifah Zarina Binti Sayed Zakariya, Abdul Samad Hadi, Mahyar Sakari	Relationship Between Awareness, Knowledge and Attitudes Towards Environmental Education Among Secondary School Students in Malaysia	World Applied Sciences Journal	22(9)	2013	470	0.174	Knowledge - attitude
2	Zarrintaj Aminrad, Sharifah Zarina Binti Sayed Zakariya, Abdul Samad Hadi, Mahyar Sakari	Relationship Between Awareness, Knowledge and Attitudes Towards Environmental Education Among Secondary School Students in Malaysia	World Applied Sciences Journal	22(9)	2013	470	0.165	Knowledge - awareness
3	Vikas S. Michekar	Correlation between environmental knowledge and environmental attitude among highschool students	Mukt Shabd Journal	9(6)	2020	100	0.448	Knowledge - attitude
4	Helder Spinola	Correlation between environmental literacy components (knowledge, attitude, and behavior) in Madiera Island (Portugal) 9th grade students	The Online Journal of New Horizons in Educations	10(1)	2020	486	0.198	Knowledge - Behavior
5	Helder Spinola	Correlation between environmental literacy components (knowledge, attitude, and behavior) in Madiera Island (Portugal) 9th grade students	The Online Journal of New Horizons in Educations	10(1)	2020	474	0.224	Knowledge - Attitude
6	Jenifer Campbell Bradley, T. M. Waliczek, & J. M. Zajicek	Relationship between enviromental knowledge and enviromental attitude of high school students	the Journal of Enviromental Education	20(3)	1999	217	-0.27	Knowledge - Attitude
7	Amir Maleki, Sara Karimzadeh	A survey of relationship between the environmental attitudes and enviromental knowledge and energy consumption behavior among citizens of Urmia, West Azerbaijan, Iran	International Journal of Social Sciences and Humanity Studies	3(1)	2012	383	0.097	Knowledge - Behaviour
8	Adugnaw Birhanu	Enviromental knowledge, attitude, and participatory behavior towards land degradation in Injibara Secondary and Prepatory School, Northwestern Euthopia	Journal of Enviroment and Earth Science	4(17)	2014	286	0.447	Knowledge - Attitude
9	Adugnaw Birhanu	Enviromental knowledge, attitude, and participatory behavior towards land degradation in Injibara Secondary and Prepatory School, Northwestern Euthopia	Journal of Enviroment and Earth Science	4(17)	2014	286	0.417	Knowledge - Behaviour
10	Sunday A. Itasanmi, Jegede Tosin E.	Investigation of market women's enviromental knowledge, attitude, and behaviour in Nigerian City of Ibadan	International Journal of Education & Literacy Studies	7(4)	2019	403	0.588	Knowledge - Attitude
11	Lutfiye Varoglu, Senar Temel, Ayhan Yilmaz	Knowledge, attitudes, and behaviours towards the enviromental issues: Case of Northern Cyprus	EURASIA Journal of Mathematics, Science, and Technology Education	14(3)	2018	145	0.46	Knowledge - Attitude

## Appendix Continued

No	Researcher	Title	Journal	Edition	Year	n	r	Variable
12	Lutfiye Varoglu, Senar Temel, Ayhan Yilmaz	Knowledge, attitudes, and behaviours towards the environmental issues: Case of Northern Cyprus	EURASIA Journal of Mathematics, Science, and Technology Education	14(3)	2018	145	0.21	Knowledge - Behaviour
13	Norshahida Akma Alias	Correlation between knowledge, attitude, and behaviour towards river pollution	International Journal of Modern Trends in Social Sciences	2(9)	2019	150	0.451	Knowledge - Attitude
14	Norshahida Akma Alias	Correlation between knowledge, attitude, and behaviour towards river pollution	International Journal of Modern Trends in Social Sciences	2(9)	2019	150	0.401	Knowledge - Behaviour
15	N S Abdul-Halim, N S Ruslan, N S U Idris, S A Nawawi	Knowledge, attitude, and practice of environmental sustainability among sustainable science students in Universiti Malaysia Kelantan	3rd International Conference on Tropical Resources and Sustainable Science, IOP Conf. Series: Earth and Environmental Science	842	2021	128	0.532	Knowledge - Attitude
16	N S Abdul-Halim, N S Ruslan, N S U Idris, S A Nawawi	Knowledge, attitude, and practice of environmental sustainability among sustainable science students in Universiti Malaysia Kelantan	4th International Conference on Tropical Resources and Sustainable Science, IOP Conf. Series: Earth and Environmental Science	842	2021	128	0.574	Knowledge - Practice
17	Sivaraman Kuppusamy, TamilSalvi Mari	Relationship between Environmental Awareness and Environmental Knowledge using "AKASA" Model among Architecture Students in private universities, Klang Valley, Malaysia.	2nd. International Conference on Knowledge Engineering and Application, 21 October 2017, London, United Kingdom	unknown	2017	234	0.815	Knowledge - Awareness
18	Hamideh Mihanpour. et. al.	Assessment of the Awareness, Attitude and Environmental Literacy about Environmental: Issues and Challenges	Preprints	unknown	2018	404	0.323	Knowledge - Attitude
19	Hamideh Mihanpour. et. al.	Assessment of the Awareness, Attitude and Environmental Literacy about Environmental: Issues and Challenges	Preprints	unknown	2018	404	0.292	Knowledge - Performance
20	Jamilah Ahmad, Shuhaida Md. Noor, Nurzali Ismail	Investigating Students' Environmental Knowledge, Attitude, Practice and Communication	Asian Social Science	11(16)	2015	854	0.217	Knowledge - Practice
21	Muhammad Mohiuddin, et. al.	Environmental Knowledge, Awareness, and Business School Students' Intentions to Purchase Green Vehicles in Emerging Countries	Sustainability	10	2018	200	0.803	Knowledge - Attitude
22	Muhammad Mohiuddin, et. al.	Environmental Knowledge, Awareness, and Business School Students' Intentions to Purchase Green Vehicles in Emerging Countries	Sustainability	10	2018	200	0.875	Knowledge - Behaviour
23	Siti Norashikin Bashirun, Shereen Noranee	Influence of environmental knowledge and attitude on employee green behaviour	International Journal of Academic Research in Business and Social Sciences,	10(6)	2020	108	-0.114	Knowledge - Behaviour

## Appendix Continued

No	Researcher	Title	Journal	Edition	Year	n	r	Variable
24	Jelle Boeve-de Pauw, Peter Van Petergem	The affect of flemish eco-schools on students environmental knowledge, attitudes, and affect	International Journal of Science Education	33(11)	2011	1287	0.159	Knowledge - Affect
25	Hans Kuhlemeie, Huub Van Den Bergh, Nijs Lagerweij	Environmental knowledge, attitudes, and behavior in Dutch Secondary Education	The Journal of Environmental Education	30(2)	1999	9000	0.44	Knowledge - Attitude
26	Hans Kuhlemeie, Huub Van Den Bergh, Nijs Lagerweij	Environmental knowledge, attitudes, and behavior in Dutch Secondary Education	The Journal of Environmental Education	30(2)	1999	9000	0.36	Knowledge - Behaviour
27	Piyapong Janmaimool and Samattaphong Khajohnmanee	Roles of Environmental System Knowledge in Promoting University Students' Environmental Attitudes and Pro-Environmental Behaviors	Sustainability	11	2019	278	0.24	Knowledge of Ecology - Attitude
28	Muhammad Tamar, Hillman Wirawan, Triani Arfah, Retno Pratiwi Sutopo	Predicting pro-environmental behaviours: the role of environmental values, attitudes and knowledge	Management of Environmental Quality: An International Journal	unknown	2019	285	0.35	Knowledge - Attitude
29	Muhammad Tamar, Hillman Wirawan, Triani Arfah, Retno Pratiwi Sutopo	Predicting pro-environmental behaviours: the role of environmental values, attitudes and knowledge	Management of Environmental Quality: An International Journal	unknown	2019	285	0.02	Knowledge - Behaviour
30	Intan Ayu Idha, et al.	The relationship between knowledge and attitude towards students' behaviour in environmental literacy	The 4th International Conference on Mathematics and Science Education (ICoMSE)	unknown	2020	272	0	Knowledge - Attitude
31	Intan Ayu Idha, et al.	The relationship between knowledge and attitude towards students' behaviour in environmental literacy	The 4th International Conference on Mathematics and Science Education (ICoMSE)	unknown	2020	272	0.02	Knowledge - Behaviour
32	Noriza Esa	Environmental knowledge, attitude and practices of student teachers	International Research in Geographical and Environmental Education	19(1)	2010	115	0.561	Knowledge - Attitude
33	Noriza Esa	Environmental knowledge, attitude and practices of student teachers	International Research in Geographical and Environmental Education	19(1)	2010	115	0.263	Knowledge - Practice
34	Maha Haidar Makki, Fouad Abd-El-Khalick, Saouma Boujaoude	Lebanese secondary school students' environmental knowledge and attitudes	Environmental Education Research	9(1)	2003	660	0.22	Knowledge - Behaviour
35	Maha Haidar Makki, Fouad Abd-El-Khalick, Saouma Boujaoude	Lebanese secondary school students' environmental knowledge and attitudes	Environmental Education Research	9(1)	2003	660	0.33	Knowledge - Attitude
36	Maha Haidar Makki, Fouad Abd-El-Khalick, Saouma Boujaoude	Lebanese secondary school students' environmental knowledge and attitudes	Environmental Education Research	9(1)	2003	660	0.3	Knowledge - Affect

Note: r = reliability index; n = sample size