

Impact Literacy Environment to Competence Community Environment in Pekanbaru City, Riau Province, Indonesia

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ABSTRACT

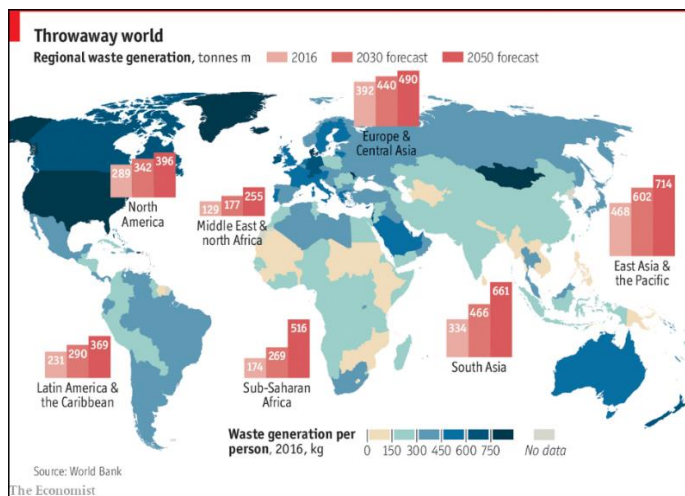
This study aims to analyze community environmental literacy, environmental competence, and the influence of environmental literacy on environmental competence. This study focuses on comprehensively assessing the environmental literacy of residents through four dimensions: environmental values, environmental responsibility, perception of environmental problems, and environmental behavioral skills. Similarly, the environmental competence of the community is evaluated through three dimensions: cognitive, affective, and methodological competence. The method used is quantitative with an ex post facto approach. Data from 65 valid surveys collected through an online questionnaire in Pekanbaru City reveal that the level of environmental literacy and environmental competence of the community is generally high, but their performance is relatively lower in dimensions such as environmental behavioral skills, environmental responsibility, and methodological competence. Further analysis shows a positive correlation between the four dimensions of environmental literacy and environmental competence. In particular, environmental behavioral skills and environmental responsibility play an important role in influencing environmental competence. Environmental literacy plays an important role in improving the community's ability to sort and process waste, while encouraging environmentally conscious behavior. Improving environmental competence through literacy has implications for sustainable development.

Keywords: Environmental competence, environmental literacy

INTRODUCTION

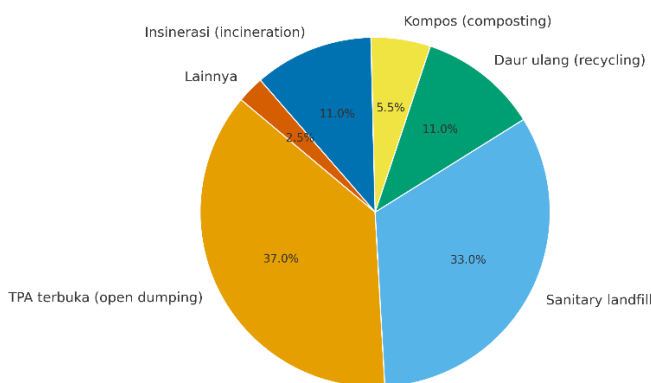
The issue of waste, which was initially considered a local issue, has now developed into a global challenge that has a systemic impact on the environment and public health. Waste is one of many environmental problems experienced by all countries in the world (Bundhoo, 2018). As human activity increases, so does the amount of waste generated (Chen, et.al, 2020; Evode, N., et.al, 2021). Globally, the volume of waste is projected to increase from 2 billion tons in 2016 to 2.5 billion tons in 2030, and to increase again in 2050 to 3.4 billion tons (The Economist, 2023; World Bank, 2018).

Figure 1.
Eruption Waste and Its Estimates Worldwide



Waste becomes a problem when it is not managed properly, such as environmental damage and threats to public health (Abdel-Shafy, H. I., & Mansour, 2018). Research shows that the accumulation of waste in residential areas increases the risk of infectious diseases such as dengue fever and leptospirosis (Axmalia, A., & Mulasari, 2020; Abadi, SHS, et.al, 2021). Waste management according to the World Bank report (2018) is illustrated in the diagram below:

Figure 2.
Percentage Processing World Waste (World Bank, 2018)



According to the World Bank (2018), of the total global waste generation of 2.01 billion tons per year, only about 19% is recycled and 11% is treated through incineration, while more than 70% of the rest is still dumped in landfills or left unmanaged. This reflects the low implementation of the 3R (reduce, reuse, recycle) principle and the circular economy,

especially in developing countries that still rely on conventional disposal methods. This condition shows that the role of the community in building environmentally conscious behavior is very important, because the success of waste management does not only depend on infrastructure and government policies, but also on community competence, especially environmental competence.

A similar situation also occurs in Indonesia, with a population of more than 273 million in 2021 (BPS, 2022), which certainly has implications for high waste generation. Data from the Ministry of Environment and Forestry (2022) shows that Indonesia produces around 68.5 million tons of waste per year, and around 17% of it is plastic waste that is difficult to decompose. This condition places Indonesia as one of the largest waste-producing countries in the world as well as a contributor to marine pollution, especially due to plastic waste (Jambeck, J. R., et.al, 2015; Puspita, R. A., & Kresnawati, 2023). Of this amount, only 12% is successfully recycled, while the majority, 66%, still ends up in landfills with conventional management systems (Malihah, L., et.al, 2023). The high production of waste, especially organic waste, which accounts for more than 60% of total household waste (Samadikun, B. P., 2023), is not balanced with an adequate management system. This creates a significant imbalance between the amount of waste produced and the capacity to manage it, leading to soil, water, and air pollution. This issue is not only technical but also educational and cultural.

This condition is also reflected in Riau Province, which produces around 2,500 tons of waste every day, with the largest contribution coming from the city of Pekanbaru as the center of economic and trade activities (DLHK Riau, 2021). In 2023, the city of Pekanbaru was one of the largest contributors of waste in Riau Province, producing 1,000 tons per day. Waste management in Pekanbaru City is carried out by collecting, transporting, and disposing of waste (KAB), which results in high costs, for example, reaching IDR 60 billion per year in Pekanbaru, while the revenue from levies is only IDR 5 billion. This is considered to be fragmented, unable to keep up with the rate of waste generation, and burdens the Muara Fajar landfill, which is almost beyond capacity. As a result, unmanaged waste volumes have emerged in the form of waste emergencies, piles at illegal waste collection points, and environmental disturbances such as pollution and drainage flooding. This is evidenced by the weak concern and supervision of the local government in managing waste, as highlighted in the Riau BPK audit that the landfill capacity will be exhausted in only 2 years, not 10 years as initially projected, and various other literature (Aulia, 2015; Febriani, R., 2020; Rizani, N., & Rahayu, 2021) further worsening the effectiveness of management. This situation shows that the waste problem in Pekanbaru is not only a technical management issue but is also closely related to public awareness and behavior towards the environment.

The increasing waste problem shows that technical solutions alone are not enough to solve the problem, but must be accompanied by an increase in community competence in environmental management (Kollmuss, A., & Agyeman, 2002; Sudarmadji, 2019). This is in line with research (Simarmata, R. O., et.al, 2025) that one of the factors causing waste problems is the community's lack of knowledge or literacy regarding waste management. This lack of literacy has an impact on low environmental awareness and a lack of practical

skills in managing waste, such as sorting, recycling, and reducing the use of single-use plastics.

Based on observations conducted by researchers in the city of Pekanbaru, it appears that the culture of sorting and processing household waste is still low. Most residents do not sort organic and inorganic waste. One of the main causes is the low level of environmental competence among the community, which is characterized by a lack of literacy or understanding and skills in managing waste independently and sustainably (Sudarmadji, 2019). The environmental competence of the community, which includes knowledge, attitudes, skills, and responsibility in managing waste independently and sustainably, is still weak. This is exacerbated by limited access to training, interactive education, and knowledge of recycling. The educational approach used is one-way and conventional, such as pamphlets and banners, which are ineffective in significantly and sustainably changing people's behavior. This situation indicates that the community's environmental competence is still low and requires urgent attention.

One of the key factors in building an environmentally conscious community is environmental literacy. Environmental literacy not only includes factual knowledge about ecological issues, but also includes awareness, attitudes, and critical thinking skills to make the right decisions related to the environment (Roth, C.E., 1992; McBride, B.B., et.al, 2013). In line with Scholz and Binder (2011), environmental literacy is a field of knowledge that encompasses the interactive relationship between humans and the environment, involving the integration of various disciplines. Meanwhile, according to Disinger and Roth (1992), environmental literacy is the main foundation for encouraging the community to behave in a consistently pro-environmental manner. Environmental literacy encompasses environmental values, environmental responsibility, perception of environmental issues, and environmental behavioral skills (Wang, J.H., Tou, L.L., 2021; Liu, L., & Tobias, 2024). Analysis of environmental literacy includes individual development through the stages of knowledge acquisition, awareness formation, and behavioral skill development. Low environmental literacy makes it difficult for people to develop practical skills and caring attitudes toward the environment, which ultimately hinders the formation of comprehensive environmental competence (Napitupulu, N. D., et al., 2025).

On the other hand, strong literacy must be implemented in the form of environmental competence, which is the actual skills and abilities of individuals and groups to manage the environment sustainably. (Hungerford, H. R., & Volk, 1990; Álvarez-García, O., et.al, 2018; Akbarova, 2021) emphasize that environmental competence includes practical skills, problem-solving abilities, and active participation in collective actions that impact environmental conservation. In other words, high environmental literacy should directly imply an increase in community competence in protecting the environment.

Low levels of environmental literacy result in communities lacking the understanding, awareness, and skills necessary to manage waste independently and sustainably. This condition implies weak environmental competence, which conceptually consists of three dimensions, namely cognitive competence (knowledge), affective competence (attitudes and values), and methodological competence (practical skills in

action). Thus, it can be said that environmental literacy is the foundation that shapes the environmental competence of the community; when environmental literacy is low, environmental competence is also low, resulting in suboptimal household waste management practices.

However, previous studies show that environmental literacy does not always correlate with environmental competence. Several studies have found a gap between the level of public knowledge about environmental issues and actual practices in everyday life (Ardoin, N. M., et.al, 2020). The public knows the importance of waste sorting, but is still reluctant to do so consistently. This shows the need for a more in-depth study of the relationship between literacy and environmental competence in the context of Indonesian society.

Based on the above background, this study will discuss in depth the extent of environmental literacy among the community in waste management in Pekanbaru City, Riau Province, Indonesia; environmental competence in waste management in Pekanbaru City, Riau Province, Indonesia; and the influence of environmental literacy on the environmental competence of the community in waste management in Pekanbaru City, Riau Province, Indonesia.

METHOD

This study uses a quantitative research method with an ex post facto type. The target or population in this study is the community in the Sialangmunggu sub-district of Pekanbaru City, which consists of 65 people. The technique used in data collection was a questionnaire distributed using Google Forms with the following response options: Strongly Agree (SS), Agree (S), Neutral (N), Disagree (TS), and Strongly Disagree (STS). The questionnaires for each variable were compiled based on variable indicators with the following number of statements: (a) environmental competence 21 statements; and (b) environmental literacy 20 statements. The indicators used for the environmental competence variable were adapted from the opinions of Hungerford & Volk (1990), Álvarez-García et al. (2017), and Akbarova (2022), namely: a) cognitive competence; b) affective competence; and c) methodological competence. Meanwhile, the environmental literacy indicators were adapted from (Liu, L., & Tobias, G. R., 2024), namely: a) environmental values, b) environmental responsibility, c) perception of environmental problems, and d) environmental behavioral skills.

The research data was analyzed using the SPSS (statistical package for social science) Version 23 program. The analyses used were descriptive analysis, correlation tests, and regression tests to determine the effect of environmental literacy on environmental competence.

The research hypotheses are:

H₀: $\rho_{x1.y} \leq 0$ There is no positive and significant influence between environmental literacy and environmental competence in Pekanbaru City.

H₁: $\rho_{x1.y} > 0$ There is a positive and significant influence between environmental literacy and environmental competence in Pekanbaru City.

Furthermore, to facilitate the implementation of the research, it can be described in the form of a conceptual framework, namely:

DISCUSSION

The results of descriptive statistical analysis based on research variables and respondent demographics grouped into two categories, namely gender and age range. The results show that:

Table 1.
Descriptive Statistical Analysis of Variables

Variables	Information	Statistical Results
Competence Environment	n	65
	Mean	3.57
	Median	3.59
	Mode	3.33
	Minimum	2.48
	Maximum	4.10
	Sum	157.51
Literacy Environment	n	65
	Mean	3.71
	Median	3.72
	Mode	3.55
	Minimum	1.85
	Maximum	5.00
	Sum	163.40

Source: 2025 Data Processing

The results of descriptive statistical analysis of the variables show that environmental competence has an average of 3.57 with a median of 3.59 and a mode of 3.33, while community environmental literacy has an average (mean) of 3.71 with a median of 3.72 and a mode of 3.55. The wide range of scores for both variables (literacy: 1.85–5.00; competence: 2.48–4.10) indicates variation between individuals. The results of the study show that the community has relatively high environmental literacy compared to environmental competence, meaning that the community has a good understanding of environmental issues, but their application in daily practice is not always optimal. This is in line with the opinion (Goldman, D., et.al, 2017) that environmental literacy is an important foundation for the application of environmental competence.

Table 2.
Descriptive Statistical Analysis of Demographics

NO	Demographics	Indicator	N	Mean	Interpretation
Competence Environment					
1	Gender	Man	23	3.27	Currently
		Woman	42	3.45	Tall
	Average		65	3.36	Currently
2	Age	Age 20-34 Years	12	3.47	Tall
		Age 35-44 Years	33	3.54	Tall
		Age 45-54 Years	17	3.55	Tall
		Age 55 years and above	3	3.30	Currently
	Average		65	3.46	Tall
Literacy Environment					
1	Gender	Man	23	3.45	Tall
		Woman	42	3.48	Tall
	Average		65	3.47	Tall
2	Age	Age 20-34 Years	12	3.45	Tall
		Age 35-44 Years	33	3.45	Tall
		Age 45-54 Years	17	3.47	Tall
		Age 55 years and above	3	3.40	Tall
	Average		65	3.44	Tall

Source: 2025 Data Processing

The results of the analysis show that environmental competence and environmental literacy among the community differ relatively based on gender and age. Women tend to have higher environmental competence than men, in line with the findings (Anisafarah, S., & Wahyuni, 2025; Sari, N., et.al, 2019) that women are more concerned about environmental issues due to their social roles and values. For example, in China, women are more concerned about the environment, more supportive of plastic ban policies, and more consistent in practicing the 3Rs (avoid single-use, reuse bags) than men (Li, Y., Wang, B., & Saechang, 2022).

Then, in terms of age, the adult group (35–54 years) showed a higher level of environmental competence and literacy than the younger and elderly groups. Adult environmental literacy is more understanding and stronger in terms of attitudes and behaviors that care for the environment (Klein, S., et al., 2021). In addition to gender (Goldman, D., et.al, 2017) states that one of the factors that influence environmental literacy is education and direct involvement in environmental activities or experiences.

Based on the above analysis, it can be concluded that environmental competence and environmental literacy are relatively high or good in each group, but there is still a need to improve environmental competence, especially for men who are still in the moderate category. Therefore, improvements are needed, such as: practical education, participatory activities, the use of role models, easy access to information, and rewards for active participation, so that the gap between literacy and actual practice can be reduced and environmental competence can be improved overall.

Table 3.
Descriptive Statistical Analysis based on Variables

No	Indicator	Mean	Interpretation
1	Competence Cognitive	3.58	Tall
2	Competence Affective	3.93	Tall
3	Competence Methodology	3.27	Currently
	Average	3.59	Tall
1	Values environment	3.85	Tall
2	Responsibility environment	3.89	Tall
3	Perception environment	4.09	Tall
4	Skills environment	3.01	Currently
	Average	3.71	Tall

Source: 2025 Data Processing

The results of the analysis per indicator show that the cognitive competence of the community is in the high category (mean = 3.58), affective competence is also high (mean = 3.93), while methodological competence is in the moderate category (mean = 3.27). The overall average environmental competency is 3.59, which is high, indicating that the community generally has knowledge and awareness of environmental issues and shows a positive attitude towards environmental conservation. However, the relatively lower methodological competency indicates limitations in the ability to effectively practice and implement environmental strategies. (Yildirim, M. S., et.al, 2025) highlights the importance of developing practical skills to improve environmentally friendly behavior.

Then, the overall environmental literacy of the community is in the high category (mean = 3.71), with high values, responsibilities, and environmental perceptions, while environmental skills are still in the moderate category, namely 3.01. This means that understanding and awareness of environmental issues are quite good, but the application of real practices still needs to be improved. The community's understanding of environmental values and good environmental skills can improve the community's environmental competence to care for the environment (Napitupulu et al., 2025). The same applies to high environmental responsibility (Harris, N. C., et.al, 2025) and awareness of caring for the environment (Yildirim, et.al., 2025).

These findings are in line with research (Miterianifa, M., & Mawarni, 2024) on environmental literacy, which emphasizes the ability of individuals to understand, apply, and participate in complex environmental issues, including the ability to interpret scientific information and apply environmental principles in everyday life. High environmental literacy can be an important foundation for competency development, but it needs to be accompanied by practical experience through active, interactive, and experience-based learning models so that knowledge, attitudes, and skills can be consistently applied in environmentally friendly behavior (Napitupulu et al., 2025).

Table 4.
Research Hypothesis Test

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,376	1	3,376	88,150	,000 ^b
	Residual	1,609	63	,038		
	Total	4,985	64			
a. Dependent Variable: Competence Environment						
b. Predictors: (Constant), Literacy Environment						

a. Dependent Variable: Competence Environment

b. Predictors: (Constant), Literacy Environment

Source: 2025 Data Processing

The ANOVA results show that the regression model between environmental literacy and environmental competence is statistically significant, with an F value of 88.150 and Sig. = 0.000 < 0.05. This indicates that environmental literacy has a significant effect on environmental competence. This means that variations in environmental competence among communities can largely be explained by their level of environmental literacy. The higher the environmental literacy, the higher the environmental competence of individuals. This finding is in line with (Liu, J., & Green, 2024) that environmental literacy plays a very important role in increasing environmental competence and shaping pro-environmental behavior. Environmental literacy is not only theoretical knowledge, but also includes practical skills and attitudes that influence real actions in environmental management ((Idris, M., et.al, 2022; Rahmat, H. K., et.al, 2025).

High environmental literacy has a positive influence on environmental competence (Goldman, D., et al., 2017). A high level of literacy enables individuals to understand environmental issues, internalize ecological values and responsibilities, and improve the cognitive and affective abilities of the community, such as waste management, water conservation, or environmental greening. However, practical skills or methodological competencies still need to be improved through direct experience and participatory learning to bridge the attitude–behavior gap. Thus, strengthening environmental literacy through education, training, and practice-based activities can improve the community's competence in consistently applying environmentally friendly behaviors, thereby supporting nature conservation and sustainable development.

In efforts to improve environmental competence, it is important to understand the relationship between knowledge, attitudes, and the actual actions of individuals. (Marcinkowski, T., & Reid, 2019) highlight that environmental education influences student behavior. The study found that although environmental concern has a positive relationship with actual behavior, other factors such as social norms, behavioral control, and personal values also influence behavioral outcomes. These findings emphasize that to reduce the attitude–behavior gap, environmental education approaches need to be holistic, not only emphasizing knowledge and attitudes, but also paying attention to the social context and practical practices that can strengthen the application of pro-environmental behaviors.

Based on the above analysis, it can be seen that environmental literacy has a significant influence on the environmental competence of the community. A high level of literacy enables the community to understand environmental issues, internalize ecological values and responsibilities, and improve their cognitive and affective abilities. However, practical skills or methodological competence still need to be strengthened through direct experience and active participation in environmental activities to bridge the attitude–

behavior gap. These findings emphasize the importance of a holistic approach to environmental education for communities, combining knowledge, values, and practical application, so that they can consistently adopt environmentally friendly behaviors and contribute to nature conservation and sustainable development.

Table 5.
Determinant Test

R	R Square	Sig, F Change	Influence (%)	Interpretation
0.823	0.677	0,000	67.7%	Tall
<i>a. Predictors: (Constant); Literacy Environment</i>				

Source: 2025 Data Processing

The table above shows that the value of $R = 0.823$ indicates a very strong correlation between environmental literacy and community environmental competence. Then the value of R Square (r^2) is 0.677 or 67.7%, which means that environmental competence is influenced by community environmental literacy in waste management by 67.7%, while the remaining 32.3% is influenced by other factors. Furthermore, the significance of $F \text{ Change} = 0.000 < 0.05$ confirms that the influence of environmental literacy on environmental competence is statistically significant. The findings from (Zulhadrizal, Z., & Syur'aini, 2023) confirm that a waste management system based on a Waste Bank, where waste is weighed, calculated, and converted into economic value, can increase community participation while shaping an environmentally conscious mindset. This shows that the methodological competence of the community can be improved through practical experiences that link environmental knowledge with economic benefits.

Practically, these results show that environmental literacy plays a very important role in shaping community competence in dealing with environmental issues, including understanding, attitudes, values, and practical skills related to environmental management. Environmental literacy acts as a mediator in the relationship between affiliation with nature and pro-environmental behavior, especially in cities with higher levels of sustainable development (Harris, N. C., et.al, 2025). This means that the community's understanding of environmental values, environmental responsibility, environmental perceptions, and environmentally conscious behavior can strengthen the community's environmental competence so that the community is able to sort waste according to type, process waste effectively, and consistently apply environmentally friendly behavior. (Apriyanti, E., et.al, 2025) Environmental education must be responsive to the challenges and needs of the community and adaptive to developments in technology and information. This strategy is expected to transform the way people think and act towards a greener and more sustainable future.

In addition, community empowerment through environmental conservation programs has also been proven to strengthen environmental competence. (Mahdona, S. O., & Setiawati, 2023) emphasizes the importance of community empowerment in achieving sustainable development goals through active community involvement in environmental conservation. (Setiawati, S., & Pridayati, 2024) add that training based on local resources can improve community skills, strengthen cognitive and affective competencies, and foster awareness of environmental values directly. Programs such as this enable the community to not only understand environmental issues but also be able to apply practical skills relevant to waste management, thereby bridging the gap between literacy and actual practice.

Furthermore, practical implementation is needed to encourage community independence while raising awareness of environmental conservation through competency-based training in waste management (Harafah, 2023; Nurhabibah, 2023).

The impact of this increase in environmental competence is not only limited to community behavior but also has broader implications for sustainable development. Environmentally competent communities are able to make decisions that consider the sustainability of natural resources, the preservation of biodiversity, the reduction of pollution, and the promotion of environmentally friendly economic and social practices. This is in line with the principles of sustainable development, which emphasize a balance between economic growth, social welfare, and environmental conservation. Therefore, strong environmental literacy among the community not only increases pro-environmental competence but also serves as an important foundation for achieving sustainable development goals at the local and national levels.

CONCLUSION

Based on the results of the study, it can be concluded that the environmental competence of the community in the sub-district of Pekanbaru City is in the high category, but there is still a need for improvement in methodological competence. Furthermore, overall environmental literacy is also classified as high, although environmental skills still need to be improved. A high level of literacy enables the community to understand environmental issues, internalize ecological values and responsibilities, and improve cognitive and affective abilities in waste management. Regression test results show that environmental literacy has a significant influence on environmental competence, with a contribution of 67.7%, confirming the importance of literacy as a foundation in shaping community competence.

Improving the environmental competence of the community not only has an impact on waste management practices, such as sorting and processing household waste, but also has broader implications for sustainable development. An environmentally competent community is able to make decisions that consider the sustainability of natural resources, the preservation of biodiversity, and the reduction of pollution, thereby promoting a balance between economic growth, social welfare, and environmental sustainability. Therefore, strengthening environmental literacy through education, training, and participatory experiences is an important strategy for improving community competence and supporting sustainable development at the local and national levels.

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