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Factors Influencing Students' Pro-Environmental Behavior: A Systematic Literature Review

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ABSTRACT

Pro environmental behavior refers to individual efforts to protect the environment and minimize activities that can have a negative impact on the environment. The purpose of this research is to review the results of research on factors that influence students' pro-environment behavior. This research used the SLR method on articles sourced from National and International databases and obtained 20 articles published in 2019-2023. The results of the article analysis show that the factors that influence students' pro-environmental behavior are divided into 3 components, namely: 1) Socio-Demographic Factors (age, gender), 2) Internal Factors (Knowledge, Attitudes, Psychology, Values) and 3) External Factors (Economic and Social Norma). Most research is carried out to examine students' pro-environmental behavior, namely knowledge, attitudes, gender and attitude factors. Further research is recommended to look at the influence of each factor to find out the strongest predictors so as to increase students' pro-environmental behavior.

Faktor-Faktor Yang Mempengaruhi Perilaku Pro Lingkungan Siswa : A Sistematic Literature Review

ABSTRAK: *Perilaku pro lingkungan mengacu pada upaya individu untuk menjaga lingkungan dan meminimalkan kegiatan yang dapat berdampak negatif terhadap lingkungan.Tujuan penelitian ini untuk mereview hasil penelitian-penelitian tentang faktor-faktor yang mempengaruhi pro lingkungan siswa. Penelitian ini menggunakan metode SLR pada artikel-artikel yang bersumber dari database Nasional dan Internasional dan diperoleh 20 artikel yang diterbitkan pada tahun 2019-2023. Hasil analisis artikel menunjukan faktor-faktor yang mempengaruhi perilaku pro lingkungan siswa dikelompokkan menjadi 3 komponen yaitu: 1) Socio-Demographic factors (age, gender), 2) Internal Factors (Knowledge, Attitude, Psychology, Personal Norma) dan 3) External Factors (Economic and Social Norma). Penelitan paling banyak dilakukan untuk meneliti perilaku pro lingkungan siswa yaitu faktor pengetahuan, sikap, jenis kelamin dan sikap. Penelitian lebih lanjut disarankan melihat pengaruh dari masing-masing faktor untuk mengetahui prediktor yang paling kuat sehingga mampu meningkatkan perilaku pro lingkungan siswa.*

INTRODUCTION

Indonesia is a mega biodiversity country. According to National Geographic Indonesia in 2019, Indonesia's land mass ranks second in terms of biodiversity after Brazil. However, when terrestrial biodiversity combines with marine biodiversity, Indonesia becomes the country with the most biodiversity in the world (Riyan et al., 2021);(Vijeta et al., 2021). However, Indonesia is also known as a country with a high decline in biodiversity (flora and fauna). Indonesia is in sixth place as the country with the most biodiversity extinction (Sieg & Dreesmann, 2021).

The main cause of the decline in biodiversity in Indonesia is anthropocentrism, namely that humans view nature as a resource that can be exploited for human benefit and do not view nature as a system that must be respected and protected (Schneiderhan-Opel & Bogner, 2021). Exploitation of natural resources, loss and degradation of habitat, pollution, hunting, invasive species are some of the factors causing the decline in biodiversity (Ichsan et al., 2020);(Firdaus et al., 2023). Apart from that, climate change is also one of the factors causing the decline in biodiversity. Climate change can change ecosystem function and structure, reduce productivity and resource availability, and affect interactions between species (Castillo-Huitrón et al., 2020).

Problems related to environmental damage in the future are caused by a lack of environmental knowledge in understanding the importance of preserving the environment (Darwati et al., 2024);(Lestari et al., 2023). Puspita et al. (2023) argue, a reasonable effort that can accommodate environmental problems is to apply an understanding of the importance of preserving the environment which is supported by environmental awareness.

The form of awareness that is formed in a person in protecting the universe is called pro-environmental behavior (Abdullah & Keshminder, 2020). Pro-environmental behavior is an individual's effort to maintain the environment and minimize activities that can have a negative impact on the environment (Triyuni et al., 2023);(Syed-Abdullah, 2020). When students understand the importance of preserving and caring for the earth as a natural living place for living creatures, then these students are certain to have pro-environmental behavior (Jilani et al., 2021).

Apart from that, realizing pro-environmental behavior can be achieved in schools. Environmental education plays a key role in achieving this (Haka et al., 2020);(Handoko et al., 2024). Puspita et al. (2023) argue, environmental education is an important means of overcoming environmental problems with the aim of protecting and preserving the environment. The focus of environmental education is to help students understand, evaluate, and implement sustainable and environmentally friendly behavior (Hong Tian & Liu, 2022);(Kousar et al., 2022). Abdullah & Keshminder (2020) argue, through environmental education, we can learn how to overcome environmental problems, prevent further environmental damage, and protect and preserve the environment.

Based on previous research conducted by Ahmat et al. (2022), lack of exposure to real life examples can cause students' low level of environmental sensitivity. Apart from that, Aguir & Nouri (2021) explained that a lack of exposure to environmental issues causes a lack of awareness and sensitivity towards the environment. This is in line with research by Ural & Dadli (2020), which states that environmental knowledge among students in Turkey is still low.

Although the types of pro-environmental behavior have been handled well, the determining factors have still received less attention (Loureiro et al., 2022). Currently there is not much data available regarding the factors that influence the pro-environment of students, especially those who receive biology material in

Indonesia (Grilli & Curtis, 2021);(Chen et al., 2020).

Before increasing students' pro-environmental behavior, it is necessary to first describe pro-environmental behavior and to determine the appropriate way to increase this behavior, factors related to environmental behavior must be investigated first. Therefore, a systematic literature review (SLR) is needed to find strategies that will help overcome the problems faced as well as identify different perspectives related to the problem being researched and reveal theories that are relevant to the case in this research which examines in more depth the factors that influence students' pro-environmental behavior (Fu et al., 2020);(Ural & Dadli, 2020).

METHOD

This research uses a systematic literature review (SLR) method which aims to identify, examine and evaluate all relevant research findings so that they are able to answer research questions (Lu et al., 2023). The systematic literature review carried out in this research is based on the steps presented by Aguir & Nouri (2021)which consist of three stages, namely planning, implementing and reporting.

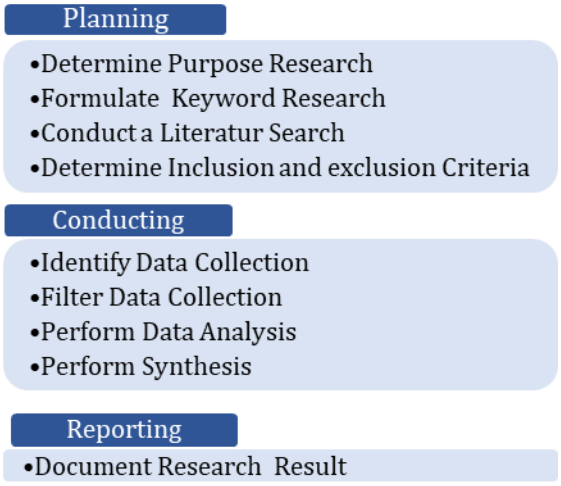

Figure 1. SLR Steps

Planning

Planning is carried out to determine the following things: a) determining research objectives, b) finding research keywords, c) determining inclusion criteria, and d) determining exclusion criteria (Hiebl, 2023). This research aims to examine the factors that influence pro-environmental behavior centered on students who receive biology material. Keyword discovery was carried out by establishing several conditions before conducting a literature search, namely: 1) The emergence of the concept of pro-environmental behavior in the literature. 2) The emergence of ideas of knowledge, attitudes, values, environmental psychology, and so on. Next, a literature search was carried out with the help of Google Scholar. Then determine inclusion and exclusion criteria to filter articles that meet the requirements. The inclusion criteria are the criteria for articles that meet the requirements for this research, including: 1) article year range 2019 to 2023, 2) studies related to Biology learning, 3) research subjects of students from junior high school to college level. Then, determine the exclusion criteria, namely the criteria for articles that do not meet the requirements for the research.

Implementation

The implementation of the systematic literature review procedure was carried out in three main stages, namely data collection identification, data filtering, data analysis (Dinter et al., 2021) and data synthesis which are presented in Figure 1. First, article identification was carried out through the Google Scholar database using Publish or Persih software. In the first stage, 86 articles were obtained that met the inclusion criteria. Articles obtained from the first stage were entered into Mendeley software to remove duplicate articles. The results of the second stage obtained 44 articles that were not duplicated. Second, filtering articles is carried out by reviewing them based on the title and abstract with the help of VOSviewer to determine the relationship between keywords.

Based on the screening that has been carried out, the factors that influence pro-environmental behavior are knowledge, age, gender, emotional, social norms, attitude, psychology, personal norms, economics, education and behavior. As a result of the third stage, 34 articles were deleted because they did not meet the inclusion criteria. Third, the data was analyzed based on full text articles by considering the exclusion criteria so that 20 relevant articles were obtained. Fourth, summarize each article in the extracted template which includes the following components: 1) author and year of publication, 2) aim/focus of the article, 3) context, 4) level, and 5) material for each article which is presented in Table 1.

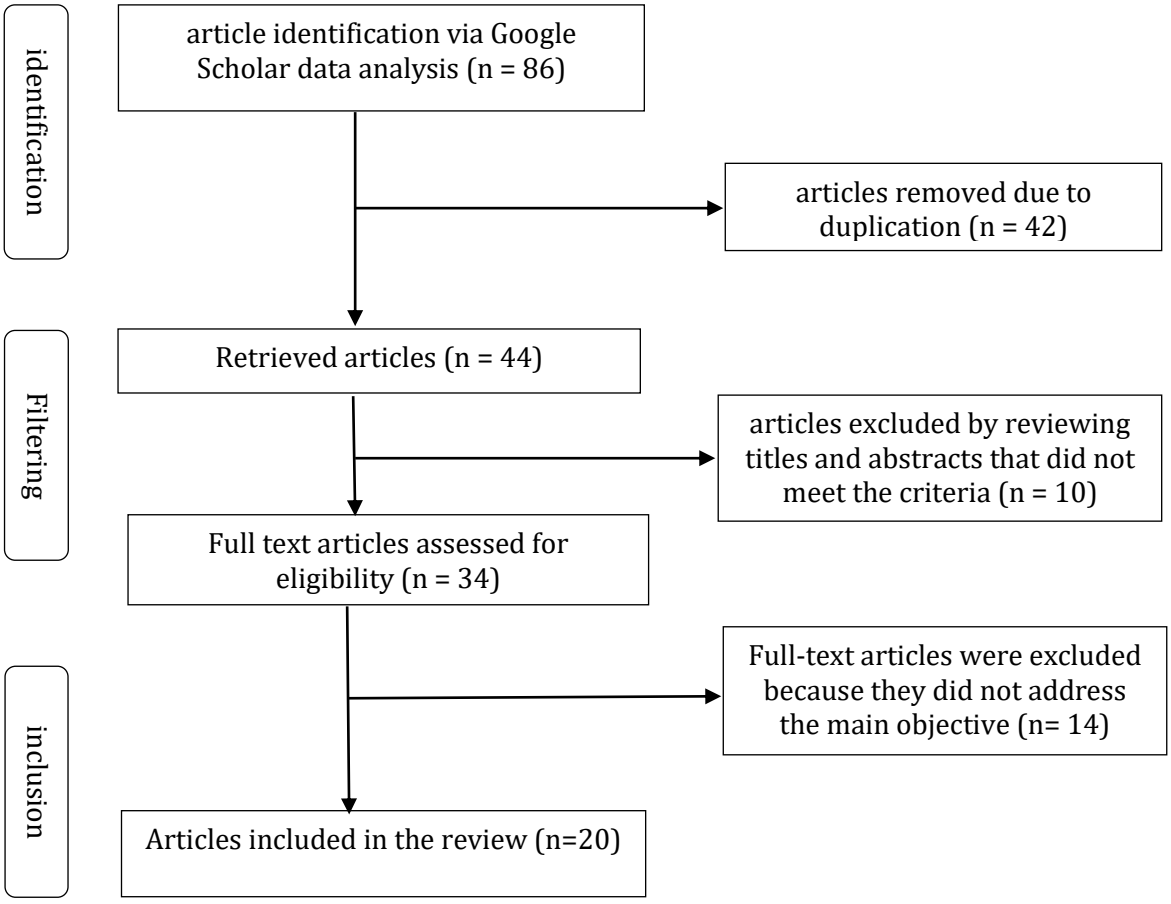

Figure 2. Flow diagram for implementing a systematic literature review

Reporting

This report aims to provide an overview of the results of analysis and synthesis of literature that fall within the inclusion and exclusion criteria which form the main part of the research article.

Table 1. Summary of Articles reviewed

No	Author, year	Research Purpose	context	Level	Content
1.	Baga, et al (2022)	Knowing pro-environmental behavior after being given different learning media based on gender.	Gender, media	Junior High School	Environmental Change
2.	Sari, et al (2023)	Analyzing environmental knowledge, place attachment and ecoliteracy on students' pro-environmental behavior.	Environmental knowledge, emotional, environmental literacy,	Senior High School	Biology
3.	Datau, et al (2019)	Knowing the personality and pro-environmental behavior of students' moral behavior	Big Five Personality	Senior High School	Biology
4.	Rahman, et al (2020)	Knowing the value orientation and pro-environmental behavior of students	Value Orientation	Senior High School	Biology
5.	Putri (2021)	Knowing climate change knowledge and personal values with students' pro-environmental behavior	Self-concept, environmental conservation, climate change	Senior High School	Biology
6.	Sigit, (2019)	Knowing the relationship between environmental responsibility and pro-environmental behavior	Environmental responsibility	Undergraduate Students	Biology
7.	Sieg & Dreesmann (2021)	Testing pro-environmental behavioral intentions and knowledge, attitudes, fears, interests, and enjoyment of learning in school interventions	Knowledge, attitudes, interests, bees, biodiversity, enjoyment of learning	Junior High School	Biologi, Neurologi dan ethologi
8.	Ichsan, et al (2020)	Measuring PEB of class VII students	Green consumerism.	Junior High School	Environmental Change
9.	Schmiedebach, et al (2022)	Investigating the relationship between gender, age, education level, pro-environmental behavior and students' environmental attitudes	Environmental attitudes, age, gender, (participation in the future Friday movement)	Junior High School Senior High School	Photosynthesis and Enzyme Reactions
10.	Yusup (2019)	Explaining students' environmental knowledge regarding gender, years of education, and parents' educational background.	Socio-demographic factors, environmental knowledge environmental literacy	Senior High School	Environmental Biology
11.	Anggereini & Yelianti (2019)	Interest in learning and critical thinking skills influence students' pro-environmental behavior	Critical thinking, interest	Senior High School	Environmental Change
12.	Opel & Bogner (2021)	The influence of environmental values on the environmental knowledge of German elementary school students	environmental knowledge, environmental values, environmental education, water supply, environmental	Elementary School	Biology

No	Author, year	Research Purpose	context	Level	Content
13.	Ichsan, et al (2021)	Describe student HOTS and PEB and examine the use of e-learning	COVID-19, E-learning, HOTS, New normal	Undergraduate Students	Environmental pollution
14	Anggereini & Siburian (2020)	Seeing the influence of the learning environment based on a mini research project that integrates PEB and ecosystem knowledge on students' critical thinking abilities.	Mini Research Project Learning, Pro Environmental Behaviour, Critical Thinking Skill.	Senior High School	Ecosystem
15.	Istiana, et al (2020)	Obtain information about the relationship between naturalistic intelligence and pro-environmental behavior.	Naturalist Intelligence, Sequential Explanatory	Senior High School	Biology
16.	Schmitz (2019)	Evaluating the environmental attitudes of 196 students from a Brazilian University.	Environmental education, Future teachers, Sustainable attitudes.	Undergraduate Students	Environmental
17.	Ichsan et al, (2022)	Describe the PEHB profile of elementary school students in biology learning.	Biology Learning, Contextual Behavior, Pro-Environmental Health Behavior	Elementary School	Biology
18	Anggereini et al (2023)	Analyzing the influence of learning PEB behavior using a mini research project on problem solving abilities and how big the influence	Problem Solving, mini research,	Senior High School	Biology
19	Stenberdt & Makransky (2023)	Investigating the feasibility of an alternative educational approach to improving waste management in the classroom by leveraging mastery experiences in IVR.	Virtual reality, Climate change education, Waste management, Exaggerated feedback	Senior High School	Climate change
20	Djuwita & Benyamin (2019)	Describes whether green school students have a higher connection with nature so they will behave more environmentally friendly, compared to students from schools with a regular national curriculum.	Nature relatedness, PSchools' curriculum, Students	Elementary School	Biology

RESULTS AND DISCUSSION

Base on the reults of the systematic literature review, 86 articles were obtained. After the screening process, 20 articles were obtained regarding factors that influence students' pro-environmental behavior which were classified into three categories in table 2.

Table 2. Factors of Student Pro-Environmental Behavior

No	Faktor-faktor Pro Lingkungan Siswa
1	Socio-Demographic Factors (Age, Gender)
2	Internal Factors (Knowledge, Attitude, Psychology, Personal Norms)
3	External Factors (Economy, Social Norma)

Through the factors that have been explained, an appropriate conceptual model can be drawn regarding the factors that influence students' pro-environmental behavior, namely the Kollmus & Agyemen (Juhari et al., 2023) model in Figure 3.

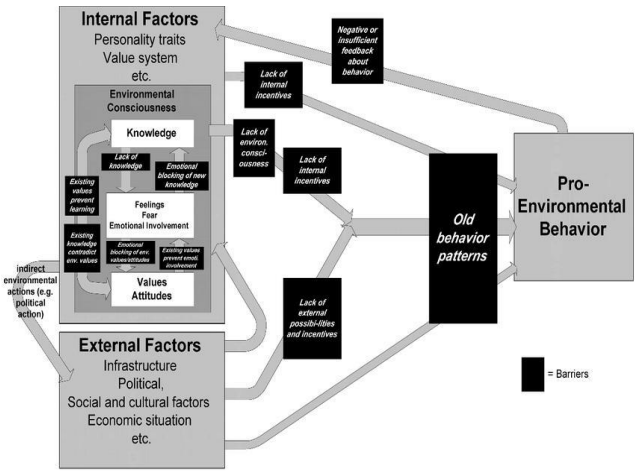

Figure 3. Model of pro-environmental behavior

Kollmus & Agyeman's model of pro-environmental behavior as a theoretical framework is similar to the research results obtained. Kollmus and Agyeman analyzed factors found to have an influence, positive or negative, on pro-environmental behavior. These factors include: demographic factors, external factors (institutional, economic, social and cultural) and internal factors (motivation, pro-environmental knowledge, awareness, values, attitudes, emotions, locus of control, responsibility and priorities.

According to Kolmus & Agyeman's model, pro-environmental behavior arises because it is influenced by knowledge variables, knowledge about the behavioral strategies a person uses towards the environment, and even knowledge about environmental culture (Hamzah & Tanwir, 2021);(Hong Tian & Liu, 2022). The element of knowledge plays a role in forming attitudes and behavior. Other factors that influence the formation of pro-environmental behavior are attitudes towards the environment (attitudes), Fear (anxiety), social and cultural factors (social and cultural factors), Feelings (feelings), and emotional (emotions). Emotional factors are intense feelings directed towards someone or something and a series of tendencies to act pro-environmentally (Mohammadi et al., 2023);(Ateş, 2020).

Socio-Demographi Factors

Gender

Female students show a more pro-environmental attitude than male students. Women show more concern for the environment and are more willing to behave in environmentally friendly ways than men (Ali et al., 2021). It is important for teachers to have the same influence on female and male students in terms of environmental education (Okumah et al., 2020); (Concari et al., 2020). Teachers must realize that they need to provide adequate environmental knowledge and highlighting the importance of pro-environmental thinking, especially to male students (Yuriev et al., 2020). This can be achieved by talking about some everyday items that all students use, such as talking about microplastics in cosmetics, artificial grass, clothing, tire wear particles, etc. by emphasizing that all genders are affected by ecological well-being and must act pro-ecologically (Verschoor et al., 2021).

At the university level, it was also found that the pro-environmental behavior of female undergraduate students was

higher than that of male undergraduate students. This is because women have a higher level of responsibility in protecting the environment and care for others in taking responsibility for reducing evironmenal problems (Macgregor et al., 2022);(Afsar & Umrani, 2020). Ordinary women are trained from an early age to be more expressive, sympathetic, nurturing, cooperative, independent and helpful. In addition, environmentally related behaviors mostly occur at home, such as saving electricity, using recycled products, and purchasing household products (Bhutto et al., 2021);(Pohl et al., 2021);(Hossain et al., 2022)

Age

Older people behave better environmentally than younger people. Older humans play a more important role in PEB than younger humans. Young people show little commitment to a general system of values, do not feel connected to the current social order and can accept massive disruption of the social order (Mayr & Freund, 2020).

However, not all research obtains things that match theory, such as Wallis & Loy (2021) explaining that 19 year old students implement more pro-environmental behavior than 21 year old students. The discrepancy between the results of this study and theory could be caused by the close age range of the respondents so that it does not have a big influence on student behavior scores. Based on literature analysis, students at university level have better pro-environmental behavior than junior high school students (Yamane & Kaneko, 2021). It is proven that a higher level of education produces more knowledge in relevant scientific disciplines so as to develop an understanding of various aspects of the environment.

Internal Factors

Knowledge

Knowledge about the current state is a strong predictor of engaging in pro-environmental behavior (Handoyo et al., 2021). Environmental knowledge is an individual's understanding of the environment and human actions that influence the ecosystem (Ajibade & Boateng, 2021);(Tamar et al., 2021). Environmental knowledge is the basis for understanding the impact of human behavior on the environment so that environmental knowledge is important in solving environmental problems.

Ienna et al. (2022) argue, highlight environmental knowledge as factual knowledge regarding environmental topics, definitions and policies. Apart from that Amoah & Addoah (2021) said that environmental knowledge is indeed a necessary prerequisite for environmental action. However, there are some environmental actions such as reducing waste and saving energy that can be done as an individual habit that does not require environmental knowledge (Ienna et al., 2022).

Students who receive environmental education in K-10 are more likely to engage in pro-environmental behavior. Environmental education in universities can also increase students' willingness to take pro-environmental actions. Self-education through media and online resources can also increase environmental knowledge and influence behavior.

Attitude

Attitude towards the environment is an assessment that a person makes regarding behavior they like or dislike (Sabirov, 2021). Environmental attitudes are the way students become aware of their environment, adjust their behavior, and treat the ecological environment in a protective manner (Amin et al., 2020); (Ibáñez et al., 2020). Someone who has an optimistic attitude towards a behavior will have greater behavioral intentions. A positive attitude towards PEB can certainly influence the intention to carry out PEB positively (Shutaleva et al., 2022).

Environmental attitudes are considered as indicators and components to predict a person's environmental behavior. This can be seen when the rise of environmental issues can influence individual environmental attitudes to act pro-environmentally. Environmental attitudes provide a good understanding of the set of beliefs, interests, and guidelines that encourage environmental or pro-environmental practices (Dhir et al., 2021).

Apart from that, many students are interested in global problems such as climate change, air pollution and global warming, but they do not involve themselves in pro-environmental activities. Huirong et al. (2020) argue, that the relationship between environmental attitudes and PEB is not always linear. Environmental attitudes are recognized as a strong predictor of PEB but the gap between environmental attitudes and PEB still exists.

Psychology

Environmental psychology is a term that describes the relationship between human behavior and the physical environment (Meagher, 2020). Therefore, it is considered a two-way process, focusing on how attitudes and behavior impact the environment and how the environment influences people's behavior. Studies show that the physical environment plays an important role in determining behavior, emotions, interests, thoughts and overall well-being (Tam & Milfont, 2020).

Interest is part of the affective component of attitudes and indirectly influences pro-environmental behavior. Interest is described as a subjective relationship between a person and a particular object. Interest can increase attention and learning outcomes, which have an impact on the learning process and academic performance (Bradley et al., 2020);(Martin et al., 2020).

However, there is still little research on the influence of interest on behavior that supports the environment and behavioral intentions, so further research is needed to explore the relationship between interest and the desire to behave pro-environmentally. Interest also has a significant role in pro-environmental behavior and helps students to draw conclusions about behavioral intentions based on the knowledge and attitudes acquired (Boley & Mimbs, 2021).

In addition, developing a positive emotional attitude in students towards the learning process and school is an important goal in education (Karakas & Yildiz, 2020). Success in going through the learning process has an important influence on the quality of learning, academic achievement and personal happiness of students (Kang et al., 2020);(Wiener & Pazzaglia, 2021). If someone feels satisfaction when studying, this can trigger a high interest in learning. That is why, it can be concluded that students who enjoy learning and interacting show greater motivation in carrying out their intention to act pro-environmentally.

Personal Norm

Norms can be interpreted as an expectation held by an individual regarding how he or she should act in a particular social situation. According to Pomytkina et al. (2020) norms can be constructed as individuals' internal expectations about how they should act based on their inner values (Thébaud et al., 2021).

Mutlu (2020) suggests, that personal norms can be explained as internalized moral rules regarding the perception of right or wrong of a particular target behavior. Personal norms emerge from shared expectations in social interactions and can influence behavior independently of sanctions or external reinforcement through social intervention. Therefore, personal norms guide behavior based on self-expectations, and when these norms are internalized, they are integrated into the individual's self-concept (Han & Son, 2020);(Peters & D'Penna, 2020).

Personal norms make students have a moral obligation to behave in certain environmentally friendly ways which can help students develop a willingness to act (Wilkaniec et al., 2021);(Mason et al., 2022). Higher personal norms may lead to intentions to act more sensitively to the environment (Valtonen et al., 2021). It is worth noting that many studies have examined the relationship between personal norms and PEB. Yildirim (2020) investigated the positive relationship between personal norms and pro-environmental behavior. Mutlu (2020) shows that personal norms have a negative relationship with PEB. However, Johnson stated that personal norms will be a stronger predictor of influencing PEB when social norms are internalized into personal norms.

External Factors

Social Norm

Individuals are more likely to engage in pro-environmental behavior when it is considered the norm in their social group. Positive social identities related to the environment, such as being part of a community or group that supports environmental issues, can motivate pro-environmental behavior (Ichsan et al., 2020);(Abdullah & Keshminder, 2020) peer pressure and messages from the media or organizations can have a significant impact on pro-environmental behavior (Sieg & Dreesmann, 2021).

So, if environmental norms in community groups are upheld, then students as members of society will also be more environmentally friendly. Vice versa, if environmental norms in a group of people are ignored, students will be lazy about protecting the environment (Triyuni et al., 2023).

Economics

Economic factors also play a role in PEB decision making. Students or college students have high needs to support their education. While most students do not have their own income (Ahmat Zainuri et al., 2022);(Syed-Abdullah, 2020). Problems like this can result in students not having a high PEB (Hong Tian & Liu, 2022). Some PEBs as good behavior in protecting the environment have to pay higher costs, such as choosing organic food products, using renewable energy sources such as solar panels, bag prices are more expensive than plastic bags (Jilani et al., 2021);(Kousar et al., 2022).

CONCLUSIONS AND SUGGESTIONS

Pro-environmental behavior is an effort to prevent the earth from being damaged. There is great potential to reach students using appropriate methods in schools to demonstrate the importance of pro-environmental behavior. Although everyone benefits from environmental programs, only a few really care. The factors that indicate students' tendency to behave pro-environmentally are: 1) socio-demographic factors (gender and age), 2) internal factors (knowledge, attitudes, awareness, norms, psychological factors) and 3) external factors (economic, socio-cultural). This research still has many limitations, such as not having specifically linked each predictor of pro-environmental behavior. So, it is hoped that future researchers will be able to examine in more depth the relationship between factors that increase students' pro-environmental behavior.

REFERENCES

Abdullah, M. S., & Keshminder, J. S. (2020). Religion and pro-environmental behaviour: A comparative analysis towards environmental protection. *International Journal of Environment and Sustainable Development*, *19*(2), 174–194. https://doi.org/10.1504/IJESD.2020.106662

Afsar, B., & Umrani, W. A. (2020). Corporate social responsibility and pro-environmental behavior at workplace:

The role of moral reflectiveness, coworker advocacy, and environmental commitment. *Corporate Social Responsibility and Environmental Management*, *27*(1), 109–125. https://doi.org/10.1002/csr.1777

Aguir, B. S., & Nouri, F. Z. (2021). History of the Human and Nature Relationship, Discovery of Greenhouse Effect and Awareness of the Environmental Problem. *Journal of Economic Science Research*, *4*(3), 23–34. https://doi.org/10.30564/jesr.v4i3.3120

Ahmat, Z. N., Abd-Rahman, N., Halim, L., Chan, M. Y., & Mohd Bazari, N. N. (2022). Measuring Pro-Environmental Behavior Triggered by Environmental Values. *International Journal of Environmental Research and Public Health*, *19*(23). https://doi.org/10.3390/ijerph192316013

Ajibade, I., & Boateng, G. O. (2021). Predicting why people engage in pro-sustainable behaviors in Portland Oregon: The role of environmental self-identity, personal norm, and socio-demographics. *Journal of Environmental Management*, *289*(4), 112538. https://doi.org/10.1016/j.jenvman.2021.112538

Ali, M. I., Rachman, S. A., & Hasim, A. H. (2021). Sustainable environmental education for pro-environmental engineering students: The assessment of a measurement model. *Global Journal of Engineering Education*, *23*(2), 156–162.

Amin, S., Utaya, S., Bachri, S., Sumarmi, & Susilo, S. (2020). Effect of Problem-Based Learning on critical thinking skills and environmental attitude. *Journal for the Education of Gifted Young Scientists*, *8*(2), 743–755. https://doi.org/10.17478/jegys.650344

Amoah, A., & Addoah, T. (2021). Does environmental knowledge drive pro-environmental behaviour in developing countries? Evidence from households in Ghana. *Environment, Development and Sustainability*, *23*(2), 2719–2738. https://doi.org/10.1007/s10668-020-00698-x

Ateş, H. (2020). Merging Theory of Planned Behavior and Value Identity Personal norm model to explain pro-environmental behaviors. *Sustainable Production and Consumption*, *24*, 169–180. https://doi.org/10.1016/j.spc.2020.07.006

Bhutto, M. Y., Liu, X., Soomro, Y. A., Ertz, M., & Baeshen, Y. (2021). Adoption of energy-efficient home appliances: Extending the theory of planned behavior. *Sustainability (Switzerland)*, *13*(1), 1–23. https://doi.org/10.3390/su13010250

Boley, B., & Mimbs, M. (2021). Measuring Place Attachment with The Abbreviated Place Attachment Scale (APAS). *Journal of Environmental Psychology*, *1*(1), 1–32. https://doi.org/10.1016/j.gfj.2020.100540

Bradley, G. L., Babutsidze, Z., Chai, A., & Reser, J. P. (2020). The role of climate change risk perception, response efficacy, and psychological adaptation in pro-environmental behavior: A two nation study. *Journal of Environmental Psychology*, *68*, 101410. https://doi.org/10.1016/j.jenvp.2020.101410

Castillo-Huitrón, N. M., Naranjo, E. J., Santos-Fita, D., & Estrada-Lugo, E. (2020). The Importance of Human Emotions for Wildlife Conservation. *Frontiers in Psychology*, *11*(5), 1–11. https://doi.org/10.3389/fpsyg.2020.01277

Chen, J., van Tulder, R., Hu, T. E., & Kwakkenbos, T. (2020). Why people do not keep their promise: Understanding the pro-environmental behavior in China. *Sustainability (Switzerland)*, *12*(17), 1–17. https://doi.org/10.3390/SU12176720

Concari, A., Kok, G., & Martens, P. (2020). A systematic literature review of concepts and factors related to pro-environmental consumer behaviour in relation towaste management through an interdisciplinary approach. *Sustainability (Switzerland)*, *12*(11). https://doi.org/10.3390/su12114452

Darwati, E., Ubaidillah, M., Sahrir, D. C., & Oktina Sari, A. O. S. (2024). Application of the Environmental Exploration Approach (JAS) Assisted by QR Codes to Increase Scientific Literacy Aspects of Competency and Conservation Attitudes in Plantae Material. *Biosfer: Jurnal Tadris Biologi*, *14*(2), 245. https://doi.org/10.24042/biosfer.v14i2.18553

Dhir, A., Sadiq, M., Talwar, S., Sakashita, M., & Kaur, P. (2021). Why do retail consumers buy green apparel? A knowledge-attitude-behaviour-context perspective. *Journal of Retailing and Consumer Services*, *59*(October), 102398. https://doi.org/10.1016/j.jretconser.2020.102398

Dinter, van R., Tekinerdogan, B., & Catal, C. (2021). Automation of systematic literature reviews: A systematic literature review. *Information and Software Technology*, *136*(April), 106589. https://doi.org/10.1016/j.infsof.2021.106589

Firdaus, A., Lestari, F., Afiff, S. A., & Herdiansyah, H. (2023). Integration of knowledge and local wisdom for disaster resilience in Anak Krakatau volcano. *Jàmbá - Journal of Disaster Risk Studies*, *15*(1), 1–12.

Fu, L., Sun, Z., Zha, L., Liu, F., He, L., Sun, X., & Jing, X. (2020). Environmental awareness and pro-environmental behavior within China's road freight transportation industry: Moderating role of perceived policy effectiveness. *Journal of Cleaner Production*, *252*. https://doi.org/10.1016/j.jclepro.2019.119796

Grilli, G., & Curtis, J. (2021). Encouraging pro-environmental behaviours: A review of methods and approaches. *Renewable and Sustainable Energy Reviews*, *135*(645). https://doi.org/10.1016/j.rser.2020.110039

Haka, N. B., Anggoro, B. S., Hamid, A., Novitasari, A., Handoko, A., & Puspita, L. (2020). The Development of Biology Module Based on Local Wisdom of West Lampung: Study of Ecosystem Material. *Journal of Physics: Conference Series*, *1467*(1). https://doi.org/10.1088/17426596/1467/1/012013

Hamzah, M. I., & Tanwir, N. S. (2021). Do pro-environmental factors lead to purchase intention of hybrid vehicles? The moderating effects of environmental knowledge. *Journal of Cleaner Production*, *279*. https://doi.org/10.1016/j.jclepro.2020.123643

Han, S.-I., & Son, H. (2020). Effects on cooperative learning on the improvement of interpersonal competence among students in classroom environments. *International Online Journal of Education and Teaching (IOJET)*, *7*(1), 17–28.

Handoko, A., Pratama, A. O. S., Haka, N. B., Puspita, L., Wulandari, E., Marzuki, Z. A. W., & Anggoro, B. S. (2024). Creative thinking: The Effect of Green School-Based Project Based Learning (PjBL)

Model. *E3S Web of Conferences*, *482*. https://doi.org/10.1051/e3sconf/202448204016

Handoyo, B., Astina, I. K., & Mkumbachi, R. L. (2021). Students' environmental awareness and pro-environmental behaviour: Preliminary study of geography students at state university of malang. *IOP Conference Series: Earth and Environmental Science*, *683*(1). https://doi.org/10.1088/17551315/683/1/012049

Hiebl, M. R. W. (2023). Sample Selection in Systematic Literature Reviews of Management Research. *Organizational Research Methods*, *26*(2), 229–261. https://doi.org/10.1177/10944281209868851

Hossain, I., Nekmahmud, M., & Fekete-Farkas, M. (2022). How Do Environmental Knowledge, Eco-Label Knowledge, and Green Trust Impact Consumers' Pro-Environmental Behaviour for Energy-Efficient Household Appliances? *Sustainability (Switzerland)*, *14*(11), 1–16. https://doi.org/10.3390/su14116513

Ibáñez, M. E., Ferrer, D. M., Muñoz, L. V. A., Claros, F. M., & Ruiz, F. J. O. (2020). University as change manager of attitudes towards environment (The importance of environmental education). *Sustainability (Switzerland)*, *12*(11). https://doi.org/10.3390/su12114568

Ichsan, I. Z., Sigit, D. V., Miarsyah, M., Rahman, M. M., El Islami, R. A. Z., & Husamah, H. (2020). Green Consumerism in Environmental Learning: 7th-grade Students Pro-Environmental Behavior in Science Subject. *Journal Of Biology Education Research (JBER)*, *1*(1), 25–32. https://doi.org/10.55215/jber.v1i1.2633

Ienna, M., Rofe, A., Gendi, M., Douglas, H. E., Kelly, M., Hayward, M. W., Callen, A., Klop-Toker, K., Scanlon, R. J., Howell, L. G., & Griffin, A. S. (2022). The Relative Role of Knowledge and Empathy in Predicting Pro-Environmental Attitudes and Behavior. *Sustainability (Switzerland)*, *14*(8). https://doi.org/10.3390/su14084622

Jilani, G., Yang, G., & Siddique, I. (2021). Corporate social responsibility and pro-environmental behavior of the individuals from the perspective of protection motivation theory. *Sustainability (Switzerland)*, *13*(23). https://doi.org/10.3390/su132313406

Juhari, N. F., Mohd Yusoff, Y., Alkaf, A. R., & Azmi, A. S. (2023). a Conceptual Model for Pro-Environmental Behaviour in Malaysian Educational Context. *Universiti Malaysia Terengganu Journal of Undergraduate Research*, *5*(4), 57–64. https://doi.org/10.46754/umtjur.v5i4.448

Kang, Y., Zhang, F., Gao, S., Lin, H., & Liu, Y. (2020). A review of urban physical environment sensing using street view imagery in public health studies. *Annals of GIS*, *26*(3), 261–275. https://doi.org/10.1080/19475683.2020.1791954

Karakas, T., & Yildiz, D. (2020). Exploring the influence of the built environment on human experience through a neuroscience approach: A systematic review. *Frontiers of Architectural Research*, *9*(1), 236–247. https://doi.org/10.1016/j.foar.2019.10.005

Kousar, S., Afzal, M., Ahmed, F., & Bojnec, Š. (2022). Environmental Awareness and Air Quality: The Mediating Role of Environmental Protective Behaviors. *Sustainability (Switzerland)*, *14*(6), 1–20. https://doi.org/10.3390/su14063138

Lestari, P. I., Rusdi, H., Novianty, R., Maya, S.,

& Ernawati, E. (2023). Student Eco-literacy in Preventing Ecological Damage. *Biosfer: Jurnal Tadris Biologi*, *14*(1), 33–42. https://doi.org/10.24042/biosfer.v14i1.16238

Loureiro, S. M. C., Guerreiro, J., & Han, H. (2022). Past, present, and future of pro-environmental behavior in tourism and hospitality: a text-mining approach. *Journal of Sustainable Tourism*, *30*(1), 258–278. https://doi.org/10.1080/09669582.2021.1875477

Lu, H., Zhang, W., Diao, B., Liu, Y., Chen, H., Long, R., & Cai, S. (2023). The progress and trend of pro-environmental behavior research: a bibliometrics-based visualization analysis. *Current Psychology*, *42*(8), 6912–6932. https://doi.org/10.1007/s12144-021-01809-1

Macgregor, S., Arora-jonsson, S., & Cohen, M. (2022). Caring in a changing climate. Centering care work in climate action. In *Oxfam Research Backgrounder series* (Issue May).

Martin, L., White, M. P., Hunt, A., Richardson, M., Pahl, S., & Burt, J. (2020). Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours. *Journal of Environmental Psychology*, *68*. https://doi.org/10.1016/j.jenvp.2020.101389

Mason, L., Zagni, B., Bacchin, F., Frison, C., & Scrimin, S. (2022). Children's Attentional Processes in Outdoor and Indoor Environments: The Role of Physiological Self-Regulation. *International Journal of Environmental Research and Public Health*, *19*(20). https://doi.org/10.3390/ijerph192013141

Mayr, U., & Freund, A. M. (2020). Do We Become More Prosocial as We Age, and if So, Why? *Current Directions in Psychological Science*, *29*(3), 248–254. https://doi.org/10.1177/0963721420910811

Meagher, B. R. (2020). Ecologizing Social Psychology: The Physical Environment as a Necessary Constituent of Social Processes. *Personality and Social Psychology Review*, *24*(1), 3–23. https://doi.org/10.1177/1088868319845938

Mohammadi, Y., Monavvarifard, F., Salehi, L., Movahedi, R., Karimi, S., & Liobikienė, G. (2023). Explaining the Sustainability of Universities through the Contribution of Students' Pro-Environmental Behavior and the Management System. *Sustainability (Switzerland)*, *15*(2), 1–23. https://doi.org/10.3390/su15021562

Mutlu, A. (2020). Evaluation of students' scientific process skills through reflective worksheets in the inquiry-based learning environments. *Reflective Practice*, *21*(2), 271–286. https://doi.org/10.1080/14623943.2020.1736999

Okumah, M., Martin-Ortega, J., Novo, P., & Chapman, P. J. (2020). Revisiting the determinants of pro-environmental behaviour to inform land management policy: A meta-analytic structural equation model application. *Land*, *9*(5), 1–33. https://doi.org/10.3390/LAND9050135

Peters, T., & D'Penna, K. (2020). Biophilic design for restorative university learning environments: A critical review of literature and design recommendations. *Sustainability (Switzerland)*, *12*(17). https://doi.org/10.3390/su12177064

Pohl, J., Frick, V., Hoefner, A., Santarius, T., & Finkbeiner, M. (2021). Environmental saving potentials of a smart home

system from a life cycle perspective: How green is the smart home? *Journal of Cleaner Production*, *312*(June), 127845. https://doi.org/10.1016/j.jclepro.2021.127845

Pomytkina, L., Gudmanian, A., Kovtun, O., & Yahodzinskyi, S. (2020). Personal choice: Strategic life decision-making and conscience. *E3S Web of Conferences*, *164*, 1–12. https://doi.org/10.1051/e3sconf/202016410021

Puspita, L., Rakhmawati, I., & Komarudin, K. (2023). Developing Student Worksheet Based on Islamic, Science, Environment, Technology, and Society on Junior High School Students' Critical Thinking Skills. *BIOSFER: Jurnal Tadris Biologi*, *14*(2), 273–284. https://doi.org/10.24042/b

Puspita, L., Rosa, V. A., Hidayah, N., & Velina, Y. (2023). Flipped classroom learning model assisted by the experimentation method : the impact on problem-solving skills and learning independence. *International Journal of Mathematics and Science Education Research*, *1*(2), 1–12.

Riyan, F., Utari, N., & Achmad, C. A. (2021). Nilai Konservasi Biodiversitas pada Masyarakat Dayak Kenyah Umo' Longh Malinau Kalimantan Utara sebagai Etnopedagogi Pembelajaran Biologi. *Bioeduca: Journal of Biology Education*, *3*(1), 71–81.

Sabirov, O. S. (2021). Improving Ways to Increase the Attitude of the Investment Environment. *Revista Gestão Inovação e Tecnologias*, *11*(2), 1961–1975. https://doi.org/10.47059/revistageintec.v11i2.1811

Schneiderhan-Opel, J., & Bogner, F. X. (2021). The effect of environmental values on German primary school students' knowledge on water supply. *Water (Switzerland)*, *13*(5). https://doi.org/10.3390/w13050702

Shutaleva, A., Martyushev, N., Nikonova, Z., Savchenko, I., Abramova, S., Lubimova, V., & Novgorodtseva, A. (2022). Environmental behavior of youth and sustainable development. *Sustainability (Switzerland)*, *14*(1). https://doi.org/10.3390/su14010250

Sieg, A. K., & Dreesmann, D. (2021). Promoting pro-environmental beehavior in school. Factors leading to eco-friendly student action. *Sustainability (Switzerland)*, *13*(12). https://doi.org/10.3390/su13126598

Syed-Abdullah, S. I. S. (2020). Extending the concept of pro-environmental action and behaviour: a binary perspective. *Environmental Education Research*, *26*(12), 1764–1786. https://doi.org/10.1080/13504622.2020.1850645

Tam, K. P., & Milfont, T. L. (2020). Towards cross-cultural environmental psychology: A state-of-the-art review and recommendations. *Journal of Environmental Psychology*, *71*, 101474. https://doi.org/10.1016/j.jenvp.2020.101474

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

Thébaud, S., Kornrich, S., & Ruppanner, L. (2021). Good Housekeeping, Great Expectations: Gender and Housework Norms. *Sociological Methods and Research*, *50*(3), 1186–1214. https://doi.org/10.1177/0049124119852395

Tian, Hong, & Liu, X. (2022). Pro-Environmental Behavior Research:

Theoretical Progress and Future Directions. *International Journal of Environmental Research and Public Health*, *19*(11). https://doi.org/10.3390/ijerph19116721

Tian, Huirong, Zhang, J., & Li, J. (2020). The relationship between pro-environmental attitude and employee green behavior: the role of motivational states and green work climate perceptions. *Environmental Science and Pollution Research*, *27*(7), 7341–7352. https://doi.org/10.1007/s11356-019-07393-z

Triyuni, N. N., Nadra, N. M., Susyasrini, N. P. W. A., Sukmawati, N. M. R., & Ginaya, G. (2023). Developing a Conceptual Model of Hotel Employees' Pro-Environmental Behavior Based on the Local Genious of Bali. *International Journal of Social Science Research and Review*, *6*(1), 233–246. https://doi.org/10.47814/ijssrr.v6i1.892

Ural, E., & Dadli, G. (2020). The Effect of Problem-based Learning on 7th-grade Students' Environmental Knowledge, Attitudes, and Reflective Thinking Skills in Environmental Education. *Journal of Education in Science, Environment and Health*, *6*(3), 177–192. https://doi.org/10.21891/jeseh.705145

Valtonen, T., Leppänen, U., Hyypiä, M., Kokko, A., Manninen, J., Vartiainen, H., Sointu, E., & Hirsto, L. (2021). Learning environments preferred by university students: a shift toward informal and flexible learning environments. *Learning Environments Research*, *24*(3), 371–388. https://doi.org/10.1007/s10984-020-09339-6

Verschoor, A. J., van Gelderen, A., & Hofstra, U. (2021). Fate of recycled tyre granulate used on artificial turf. *Environmental Sciences Europe*, *33*(1), 1–15. https://doi.org/10.1186/s12302-021-00459-1

Vijeta, S., Shikha, S., & Anamika, S. (2021). The principal factors responsible for biodiversity loss. *Open Journal of Plant Science*, *6*, 011–014. https://doi.org/10.17352/ojps.000026

Wallis, H., & Loy, L. S. (2021). What drives pro-environmental activism of young people? A survey study on the Fridays For Future movement. *Journal of Environmental Psychology*, *74*(June 2020), 101581. https://doi.org/10.1016/j.jenvp.2021.101581

Wiener, J. M., & Pazzaglia, F. (2021). Ageing- and dementia-friendly design: theory and evidence from cognitive psychology, neuropsychology and environmental psychology can contribute to design guidelines that minimise spatial disorientation. *Cognitive Processing*, *22*(4), 715–730. https://doi.org/10.1007/s10339-021-01031-8

Wilkaniec, A., Borowiak-Sobkowiak, B., Irzykowska, L., Breś, W., Świerk, D., Pardela, Ł., Durak, R., Środulska-Wielgus, J., & Wielgus, K. (2021). Biotic and abiotic factors causing the collapse of Robinia pseudoacacia L. veteran trees in urban environments. *PLoS ONE*, *16*(1 January), 1–20. https://doi.org/10.1371/journal.pone.0245398

Yamane, T., & Kaneko, S. (2021). Is the younger generation a driving force toward achieving the sustainable development goals? Survey experiments. *Journal of Cleaner Production*, *292*, 125932. https://doi.org/10.1016/j.jclepro.2021.125932

Yildirim, H. İ. (2020). The effect of using out-of-school learning environments in

science teaching on motivation for learning science. *Participatory Educational Research*, *7*(1), 143–161. https://doi.org/10.17275/per.20.9.7.1

Yuriev, A., Dahmen, M., Paillé, P., Boiral, O., & Guillaumie, L. (2020). Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review. *Resources, Conservation and Recycling*, *155*(November 2019). https://doi.org/10.1016/j.resconrec.2019.104660