

Challenges and Strategies to Develop Pro Environment Behaviours Among Middle School Students: A Systematic Literature Review

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Abstract

An objective of Education for Sustainable Development is to promote environmentally sustainable behavior to create a sustainable environment. However, scholars have defined pro environmental behaviors from different perspectives making it difficult to pin down how we can develop the behavior. This study presents a systematic literature review to examine the characteristics of pro-environmental behavior, challenges, and strategies used for developing pro-environmental behavior in middle school students. A search strategy was developed, and eligibility standards were applied, based on the "PICO" mnemonic and PRISMA methods. In this study, 33 articles, published from 2017 through 2023, were systematically reviewed using data from five electronic databases: Google Scholar, Web of Science, SCOPUS, Taylor & Francis, and SpringerLink. The review revealed five subthemes of general characteristics of pro environmental behavior: environmentally concerned behavior, environmentally significant behavior, environmentally responsible behavior, ecological behavior, and sustainable behavior. Second, four subthemes emerged in response to the challenge of developing pro-environmental behavior: social, economic, cultural, and individual. Additionally, effective teaching techniques and tools are the most effective way to promote pro-environmental behavior in the classroom, followed by learner-centered arrangements and outdoor programs/classroom education, educational game, green school, green lifestyle, and rewards. One of the recommendations from this SLR is to develop appropriate teaching aids and methods relevant to the respective communities, and to test the effectiveness of appropriate teaching aids and methods on developing pro environmental behaviors.

Keywords: Challenges, Pro Environmental Behavior, Secondary Schools, Middle Student Schools

Introduction

Numerous environmental issues, including environmental pollution, the expansion of acid rain, resource scarcity, ozone layer erosion, and biodiversity loss, pose a danger to human sustainability (Manisalidis et al. 2020). Since many of these issues are brought on by certain behaviors, changing such behaviors can help reduce the negative environmental impacts of the problems. In conjunction with this context, in both social psychology and environmental psychology, "pro-environmental behavior" has continuously grown over the past 20 years as a study hotspot. The quality of our lives will be impacted by how humans treat the environment (Mario et al. 2020). Many academics are starting to focus on how human behavior and the environment interact. Decisions in the future about natural resources and how to utilize them sustainably through either direct or indirect means will be influenced by knowledge, morals, feelings, attitudes, and behavior among adolescents, as well as their sense of environmental responsibility.

The very multifaceted notion, pro-environmental behaviors (PEBs) have been defined from a variety of angles by scholars (Tezel et al. 2018; Mónus, 2020; Jia & Yu, 2021). Therefore, it is difficult for scholars to obtain consistent knowledge on how to acquire PEB. Various factors contributing to development of PEBs have been considered in the past, such as personal norms, attitudes, intents, value orientations, motivation, environmental concerns, self-identity, role of Islamic teaching and environmental moral education. (Schultz & Kaiser, 2012; Sorqvist, 2016; Kim & Yun, 2019; Chiang et. al, 2019; Kot et al. 2019; Begum et al. 2021).

The research of pro-environmental conduct among middle school students demonstrates its enormous importance. Middle school is a critical developmental stage that bridges the gap between childhood and adolescence. Young people begin to shape their own beliefs, attitudes, and actions during this formative period. These early environmental behaviors and perspectives can have long-term consequences on their future decisions. Understanding the elements impacting environmental consciousness and behaviors among middle school children is important not only for academic purposes, but also for our global environmental well-being. Fostering pro-environmental behaviors among young people at this impressionable age can inculcate a lifelong commitment to sustainability, fostering a generation of environmentally responsible citizens.

First and foremost, above all this research has the potential to be highly advantageous to the young people themselves. It provides individuals with the knowledge, attitudes, and practices required for environmental responsibility. This, in turn, equips individuals to make informed, long-term decisions throughout their lives. These early effects have the potential to shape their choices as customers, members of their communities, and responsible global citizens, leaving a lasting impression on their future behavior. Additionally, encouraging pro-environmental behaviour in middle school students has the potential to ripple across society, establishing an eco-conscious culture. This, in turn, can result in real benefits such as lower energy use, less waste, and better conservation efforts. It fosters the development of environmentally responsible societies and, eventually, helps to preserve our world.

Fundamentally, studying pro-environmental behavior in middle school is an endeavor that not only improves the lives and open doors of these young people, but also protects the health of our environment. This is a journey to understand the significant relationship between individual acts and their global repercussions, driving us toward a more sustainable and morally responsible world for all.

Thus, it is crucial to understand the factors contributing to individuals' tendencies to act in ways that preserve the environment and ecosystem (Richardson et al. 2020) and the

aforementioned factors could be categorized into these four factors: social, economic, cultural, and individual.

Social Factors: Categorized under this factor influencing pro-environmental behaviors involves social norms and social influence (Bergquist et al. 2019; Wang et al. 2022). People's beliefs about what is normal or acceptable behavior in their social circles or communities might have an impact on them. Studies have demonstrated that social norms, such as observing others engaging in pro-environmental behaviors or receiving social approval for such actions, can significantly increase individuals' likelihood of engaging in similar behaviors (Perry et al. 2021, Bergquist et al. 2019) There are differences between the effect of mothers and fathers on children's environmental values, which play a role in intergenerational transmission in PEBs (Thomas et al. 2018). The study demonstrated that parents' morals were significantly correlated with youths' actions. Children's absorbed values significantly contribute to pro-environmental activities.

Economic Factors: Other studies show that economic factors also play a role in developing and promoting pro-environmental behaviors. Cost factors, such as the affordability of environmentally friendly products or services, can influence individuals' choices. According to White et al. 2019, one example where the "sharing economy" has grown highlights the significant economic and environmental benefits that may be earned by shifting customers in a sustainable way—in this scenario, from own products to using existing services and products. Second, to conserve resources refers to saving resources like water (by showering rather than bathing), electricity (by turning off lights or heaters), packaging (by purchasing environmentally friendly products at the grocery store), or recycling. In 2008, people consumed 68 billion tons of materials, or 27 kilograms each every day, according to the World Watch Institute (2013, p. 114). This rate is comparable to the bio-capacity of 1.5 planets; in other words, each year we consume much more than the Earth can sustain. At the same time, the dependence on and dominance of fossil fuels persists even as countries are switching to cleaner alternatives. This presents a difficulty not only because of the need for the world to minimize its carbon footprint, but also because most countries rely on foreign, and frequently geopolitically unstable, regions, to meet their energy needs (Nunes & Catalão, 2022).

Cultural Factors: According to Chwialkowska et al. (2020) and Tezel et al.(2018), cultural values, norms, and practices can shape pro-environmental behaviors. Different cultures have varying perspectives on the environment, which may influence the importance individuals place on environmental protection. Cultural contexts can impact the adoption of sustainable practices and policies within communities and societies (Zheng et al. 2021). China is dealing with several serious environmental issues (Xu P et al. 2012; Yu X et al. 2019). Many local governments in China, for instance, are considering about enacting new garbage-sorting laws, for instance, in line with the practice in Shanghai. Therefore, it's critical to comprehend what influences Chinese people's attitudes towards the environment and how they behave in this context. At the same time, in the UK, to foster connections between the local community and the academic community, using educational games and distributing them to local school children is an innovative strategy (Dieleman & Huisingh, 2006; Robinson, 2014). This in turn helps in encouraging and promoting sustainable growth, particularly when these connections are regularly consolidated and where more sustainable behavior can be influenced.

Individual factors: Agenda 2030 has made it a priority to promote energy usage that is reliable, affordable, sustainable, and modern (Michael et al. 2019). Individual factors contribute to environmental awareness (Bradley et al. 2020). Environmental awareness, according to Hassan et al. (2010), comprises of three concepts: sustainable awareness behaviors, attitude, and emotional awareness. Like Altin et al. (2014), environmental awareness is defined as awareness of environmental concerns and active participation in environmental organizations. Poor environmental awareness has been shown in numerous studies to be a major barrier to the development of ecologically friendly behaviors as individuals (Kollmuss, 2002). Additionally, it has been revealed by Burgess et al. (1998), that environmental knowledge is essential for raising awareness of the environment and influencing pro-environmental behaviors (Ridwan et al. 2023). The key predictor of pro environmental behavior of middle school students focuses on their personal knowledge, on the causes for and perceptions of their own connection to nature, as connection to nature (Kollmuss & Agyeman, 2002; Roczen et al. 2014; Otto & Pensini, 2017). A study in Malaka Sari Urban Village, Jakarta, found that most respondents had limited knowledge about issues like the impact of plastic on the environment and individual awareness of the types of plastic in daily life, despite the existence of a community-based government program called the waste bank in the research location (Ridwan et al. 2023).

This systematic literature review was undertaken with the goal of better understanding the different types and characteristics of pro-environmental behaviors (PEBs) because of various factors.

Studying pro-environmental behavior in middle school students is a significant research field that seeks to identify the influences on the environmental attitudes and actions of young individuals. Middle school students, generally aged 11 to 17, are in a formative stage where their beliefs and conduct can be molded and guided. Middle school represents a pivotal stage in development as students navigate the transition from childhood to adolescence. During this period, they commence the process of shaping their individual beliefs, values, and behaviors. Gaining insights into their environmental attitudes and behaviors at this juncture can profoundly influence their future actions.

Examining pro-environmental behavior in middle school students is a practical and efficient endeavor because it has the potential to include and teach young people at a critical stage of development. This has the potential to have immediate environmental effects, practice enduring beliefs, and inspire a cultural shift toward increased environmental accountability. Recognizing the interconnectivity of individual decisions and global consequences, this subject offers the groundwork for building a more sustainable and ethical world for both current and future generations. Furthermore, this systematic literature review examines the obstacles and approaches related to fostering pro-environmental behaviors (PEBs) in middle school settings.

Methodology

Research Design

Figure 1 shows how the systematic literature review conducted for this article followed PRISMA guidelines. Subramaniam et al. (2022) claim that PRISMA has three major advantages. In the beginning, it offers distinct research themes that allow for organized research. Second, it develops exclusion and inclusion criteria. Thirdly, it aims to evaluate a sizable scientific database within a predetermined time limit. Identification, screening, eligibility, and quality assessment were the four processes in the reviewing process. In formulating the research

question, previous studies and PICo mnemonic were used (Shaffril et al. 2021; Lockwood et al. 2015). Based on these concepts, the authors included three main aspects as part of the review, the middle school student's 'P' (Population), pro environmental behavior 'I' (Interest) and strategies and Challenges to develop pro environmental behaviors 'C' (Context).

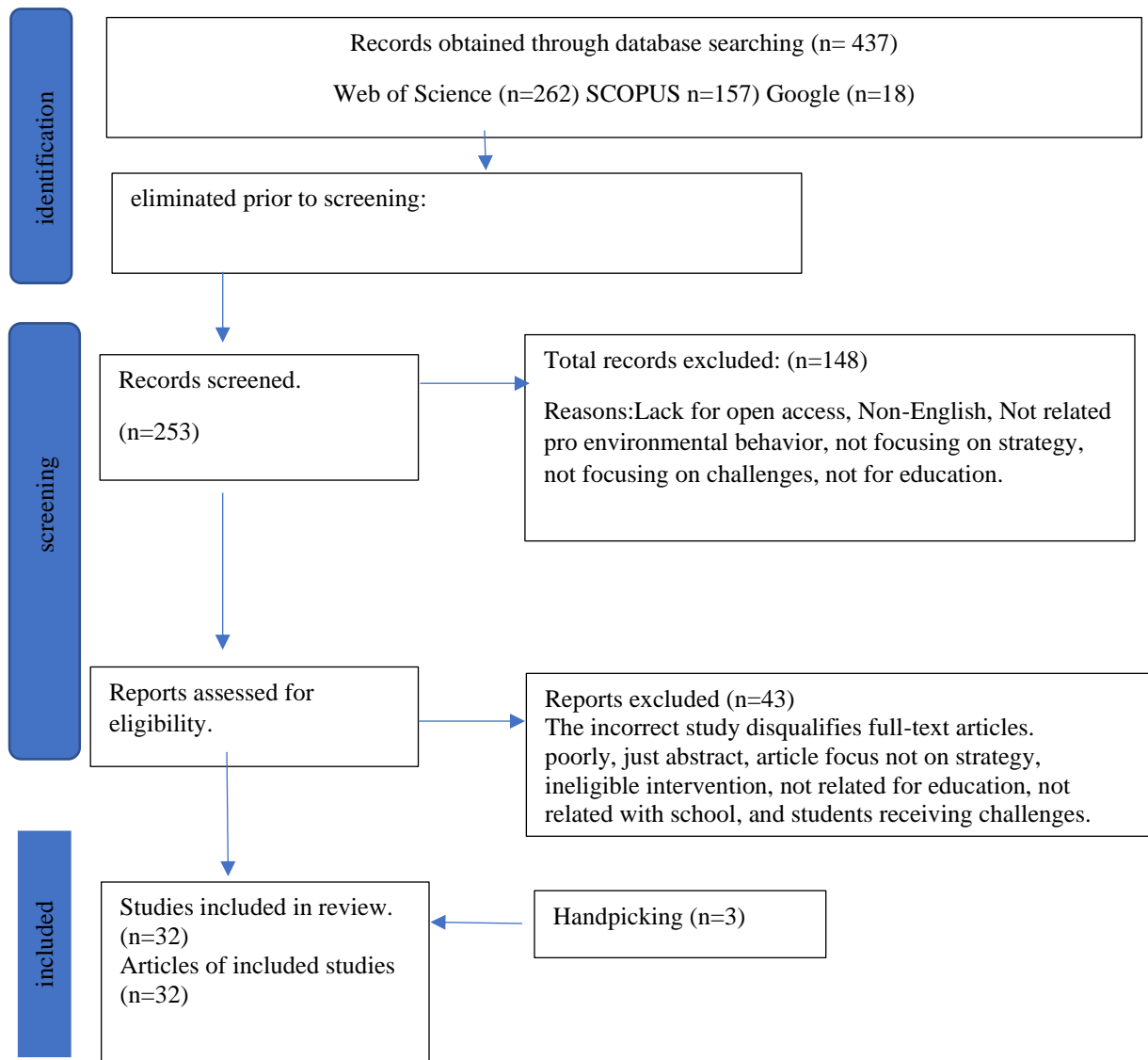


Figure 1. A flow diagram of the research selection process that has been adapted from the PRISMA design (Page et al. 2021).

Manual Google searches and advanced searches (using Web of Science and SCOPUS) were the two main ways of searching used for the present study. The phrase searching option and the Boolean operators OR and AND were both used by the researcher to combine terms in their advanced search. Handpicking, backward tracking, and forward tracking were the three manual searching methods that were mainly used in the current study (Nasir et al. 2022). This reviewing procedure was divided into four stages.

First step: identification

First, the identification phase, we added more keywords to help in choosing and extending the selected keywords to get more potential articles and ensure that the chosen keywords

would retrieve more relevant articles. By identifying synonyms, similar terms, and variations, these keywords assured adequateness during the identification stage. During the next stage, all databases were searched using the terms "pro environmental behavior" OR "PEBs") AND "middle student school" OR "high school" OR "secondary school" (shown in Table 2).

Table 2.

Keywords and searching information strategy.

Database	Search String
SCOPUS	TITLE-ABS-KEY (pro AND environmental AND behaviours) AND middle AND student AND school OR secondary AND school OR high AND school AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2023)) AND (LIMIT-TO (LANGUAGE , "english"))
WOS	TS=((pro AND environmental AND Behaviour) AND (middle AND student AND school OR secondary OR high school))

Second step: screening

Based on the criteria listed in Table 3, the screening process proceeded in the second step. The review of data covered the time frame from 2017 to 2023 for publications. Only English- or Malay-language article journals and dissertations/theses were included. The author also focuses on methods and challenges for fostering pro-environmental behaviors. At the initial stage of screening, articles 253 to 148 were excluded.

Table 3.

The inclusion and exclusion criteria

Criterion type	Inclusion	Exclusion
Language	In either English or Malay	Non-English or Non-Malay
Document type	Journal articles or dissertation or theses	Conference, proceeding or book
Topic	In the title, abstract, or keywords, the words "Pro environmental behavior or PEBs", and "Science", appear	
Year	Published between 2017 and 2023	Before 2018

Finding	They present their findings regarding the pro environmental behaviors (PEBs), challenging and strategies to develop PEBs	No impact reported on their findings
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Third step: Eligibility

After reading the title and abstract, we reviewed the whole article text in step three, the eligibility phase, with a focus on the following four inclusion criteria: 1) The articles should clearly define the characteristics of pro-environmental behavior. 2) the challenges to the development of pro-environmental behavior; and 3) strategies to support the development of pro-environmental behavior. As a result of this final eligibility check, 33 articles are evaluated. At stage four, both authors assessed the quality of each of the remaining papers, focusing particularly on the abstract, methodology, and significant findings and provide each article one of three quality ratings—poor, moderate, and high—according to Petticrew and Roberts (2008). The only items selected were of a high or moderate quality. The five quality assessment criteria that the reviewers used as a reference were modified from recommendations made by Hong et al. (2018); 1) Are strategies for developing of pro environmental behaviors among the articles' 2) Do the justifications presented in the articles for each of the challenges to adopting pro-environmental actions hold up? 3) Are there any recommendations or guidelines offered in the articles regarding strategies to encourage pro-environmental behavior? For each criterion, the reviewers had three possible answers: yes, no, or cannot tell. The reviewers for this study clearly decided that 33 papers fulfilled the minimum standard (high or moderate).

Findings/Results

These 33 articles are intended to provide an in-depth analysis of the general characteristics of pro-environmental behavior, challenges, and strategies that foster pro-environmental behavior, respectively, based on data extraction in Tables 4, 5, 6.

RQ 1: Definition of pro environmental behaviors

Table 4.

Data Extraction Table of Definition of PEBs

Authors	Year	Pro Environmental behaviour				
		environmentally concerned behavior	environmentally significant behavior	environmentally responsible behavior	ecological behavior	sustainable behavior.
Mercer et al.	2021					✓
Arı & Yılmaz	2017	✓				
Liang et al.	2018		✓			
Baierl et al.	2019			✓	✓	
Baierl et al.	2021	✓			✓	
Lovren et al.	2023				✓	
Cole et al.	2019			✓	✓	
Maurer et al.	2020			✓		
Sigit et al.	2022	✓			✓	
Brumann et al.	2022				✓	
Scopelliti et al.	2022	✓	✓	✓	✓	✓
Cincera et al.	2022					✓
Jančius et. al	2021				✓	
Gallay et. al	2021	✓				
Keith et al.	2021				✓	
Schneiderhan-Opel & Bogner	2020					✓
List et al.	2020					✓
Kellberg et al.	2023			✓		
Sarrasin et al.	2022	✓		✓	✓	
Sieg et al.	2021				✓	
Wang et al.	2022	✓				
Janakiraman et al.	2022				✓	
Zhang et al.	2023				✓	
Canlas et al.	2021	✓				
Yusliza et al.	2020					✓
Liang et al.	2022	✓				
Millaku et al.	2023				✓	
Huoponen	2023	✓		✓		✓
Eze	2020				✓	
Schubler et. al	2019	✓	✓	✓	✓	✓
Dela Peña et al.	2018	✓		✓	✓	✓
Nepras et al.	2023	✓			✓	

RQ2: Challenges to develop pro environmental behavior among middle school students.

The 33 studies used in this research revealed that the main barrier to establishing PEBs is school culture, which is followed by a lack of awareness and a lack of motivation. As illustrated in Table 5, the social, economic, cultural, and individual variables are used to categorize the analysis into sub-themes.

Table 5.

Data Extraction for Challenges.

Authors	Year	Themes								
		Social			Economy		Cultural		Individual	
		Community engagement	Gender	Ecological values of parents	Cost of environmental products	Lack of resources	School Culture	Teaching material	Lack of awareness	Lack of motivation
Mercer et al.	2021	✓								
Ari & Yilmaz	2017		✓							
Liang et al.	2018					✓			✓	✓
Baierl et al.	2019					✓			✓	✓
Baierl et al.	2021				✓				✓	
Lovren et al.	2023	✓								
Cole et al.	2019						✓			
Maurer et al.	2020	✓								✓
Sigit et al.	2022							✓		
Brumann et al.	2022								✓	✓
Scopelliti et al.	2022			✓						
Cincera et al.	2022		✓							
Jančius et al.	2021			✓						
Gallay et al.	2021	✓							✓	

Keith et al.	2021									✓
Schneiderhan-Opel & Bogner	2020						✓			
List et al.	2020						✓		✓	
Kellberg et al.	2023						✓		✓	✓
Sarrasin et al.	2022									
Sieg et al.	2021						✓	✓		✓
Wang et al.	2022				✓					
Janakiraman et al.	2022					✓				✓
Zhang et al.	2023				✓		✓			
Canlas et al.	2021						✓			
Yusliza et al.	2020					✓				
Liang et al.	2022						✓		✓	
Millaku et al.	2023						✓			
Huoponen	2023						✓			
Eze	2020						✓		✓	
Schubler et al.	2019									✓
Dela Peña et al.	2018				✓				✓	
Nepras et al.	2023				✓		✓		✓	
n =		4	2	2	5	4	12	2	11	9

Research question 3: Strategies to develop pro environmental behavior in the classroom.

The 33 studies included in this analysis revealed that the most strategies were appropriate teaching aids and methods, followed by learner-centered arrangements and outdoor education programs and outdoor classroom activities. As demonstrated in Table 6, additional strategies also emerge from the systematic literature studies.

Table 6.

Data Extraction Table of Strategies

Authors	Year	Strategies to develop pro environmental behaviour into the classroom						
		Learner-centred arrangements	Appropriate teaching aids and method	Educational game	Green school	Green lifestyle	Outdoor program/classroom education	Rewards
Mercer et al.	2021			✓				
Ari & Yilmaz	2017	✓	✓					
Liang et al.	2018	✓	✓					
Batri et al.	2019	✓	✓					
Baierl et al.	2021						✓	
Lovren et al.	2023	✓	✓				✓	
Cole et al.	2019				✓			
Maurer et al.	2020							
Sigit et al	2022		✓				✓	
Brumann et al.	2022	✓	✓					
Scopelliti et al.	2022	✓	✓					
Cincera et al.	2022							
Jančius et al.	2021	✓	✓					
Gallay et. al	2021						✓	
Keith et al.	2021							
Schneiderhan-Opel & Bogner	2020		✓				✓	
List et al.	2020	✓	✓				✓	
Kellberg et al.	2023						✓	
Sarrasin et al	2022		✓					
Sieg et al.	2021	✓	✓				✓	
Wang et al.	2022	✓	✓					
Janakiraman et al.	2022			✓				
Zhang et. al	2023							✓
Canlas et al.	2021	✓	✓				✓	
Yusliza et al.	2020							
Liang et.al	2022	✓	✓					
Millaku et. al	2023	✓	✓					
Huoponen	2023	✓	✓					
Eze	2020	✓	✓			✓		
Schüßler et al.	2019	✓	✓				✓	
Dela Peña et al.	2018	✓	✓				✓	
Nepras et al.	2023	✓	✓	✓				
n =		19	22	3	1	1	11	1

Discussion**RQ 1: Definition of pro environmental behaviors**

According to one of the definitions, pro-environmental behavior (PEB) has long been regarded as a moral concern and has been discussed widely in psychology literature (Scopelliti et al. 2022) including “environmentally concerned behavior”, “environmentally significant

behavior”, “environmentally responsible behavior”, “ecological behavior” and “sustainable behavior”. Environmentally concerned behavior refers to actions or behaviors undertaken by individuals or groups who are deeply concerned about environmental issues and take proactive steps to address them. These actions can include participating in community projects, promoting policy changes, promoting environmental organizations, and engaging in activism. Several studies have shown that it is necessary to shift the educational emphasis to foster students' development of environmental awareness and responsible behavior (Dela Peña et al. 2018). Meanwhile, according to Sarrasin et al. (2022), universalism-concern, also known as caring for nature and other people. Someone who shows awareness, concern, and understanding of environmental actions and who takes action to enhance the situation can be described as an environmentally literate person. (Moseley, 2000). In short, climate awareness is the ability of people to understand the nature of the overall environmental process and problems, their concerns about environmental quality, and the extent to which they are committed to adopting environmentally friendly behaviours in their daily lives (Kousar et al. 2022).

Environmentally significant behaviors (ESBs) refer to individual actions and choices that have a substantial impact on the environment. These behaviors can contribute positively or negatively to environmental sustainability and conservation efforts. ESBs encompass a wide range of activities, such as energy consumption, waste management, transportation choices, water conservation, and sustainable purchasing habits (Liang et al. 2018; Scopelliti et al. 2022; Schubler et al. 2019). According to Ari and Yilmaz (2016), environmentally aware students additionally develop positive views towards the environment, which encourages them to engage in pro-environmental behaviors and embrace positive attitudes towards environmentally friendly products. In a longitudinal study, Carfora et al. (2017) found a moderating impact of pro-environmental self-identity on multiple aspects of PEBs, such as reducing food waste, recycling food waste, recycling food packaging, and purchasing food.

According to Baierl et al. (2018), Cole et al. (2019), Maurer et al. (2020), and Huoponen et al. (2023), environmentally responsible behavior is centered on a person's or a group's belief of their power to influence how environmental issues and challenges are resolved. Furthermore, it is expected that each person will take responsibility for changing the environment. These eco-friendly behaviors can be categorized into 5 categories.: (1) environmental management (eco management), including recycling and energy (Cole et al. 2019; Baierl et al. 2018), (2) economic or consumer action focuses on applying financial pressure or support, such as cash contributions to environmental NGOs (Maurer, 2020), (3) appealing to others for assistance in minimizing or resolving environmental concerns or issues (Huoponen, 2023), (4) participating in politics (Maurer, 2020; Huoponen, 2023) by casting an election, lobbying for policy to address environmental concerns, and (5) taking legal action to enforce current laws, such as filing lawsuits or notifying authorities of pollution offences. This component's main goal is to look at people's intents to engage in environmentally responsible behavior, as well as their strategies for acting, abilities to recognize and assess environmental problems, and involvement in such behavior.

Ecological behavior refers to actions and choices that promote the protection and preservation of ecosystems and biodiversity (Steg & Vlek, 2009). It involves practices that minimize harm to the environment, conserve natural resources, and promote sustainable living. Ecological behaviors include recycling, reducing waste, conserving energy, and water, supporting organic and local food production, practicing responsible tourism, and advocating for environmental policies. Recent demands from UNESCO encourage environmental

education to be integrated in every core curriculum worldwide by 2025 (Lovren, 2020), reminding us of the aims that diverse educational systems are still unable to completely fulfil. Despite growing awareness and agreement among researchers and policymakers on a holistic and transformative approach to education towards more sustainable solutions, there is evidence of a persistent gap or unbalance between the cognitive, affective, and behavioral dimensions of learning outcomes in curricula and teaching at various educational levels (UNESCO, 2021; UNESCO, 2023).

Sustainable behavior involves adopting practices that conserve natural resources, reduce environmental impact, promote social equity, and contribute to long-term well-being. Sustainable behaviors encompass a wide range of actions, such as energy conservation, waste reduction, responsible consumption, ethical sourcing, and supporting renewable energy (Kollmuss & Agyeman, 2002). As a conclusion, the Table 7 shows the similarity and differences among the definitions of pro environmental behaviors:

Table 7.

Data Extraction for Similarity and differences among the definitions of PEBs.

Definition of PEBs	Action	Belief	Activities
Environmentally concerned behavior (ECB), also known as Universalism-concern	Action by individual or group		participating in community projects, promoting policy changes, promoting environmental organizations, and engaging in activism, climate awareness
Environmental significant behaviors (ESBs)	Action and Choices		energy consumption, waste management, transportation choices, water conservation, and sustainable purchasing habits.
Environmental responsible behavior (ERB)		Belief of individual or group	1)eco management, including recycling and saving energy, (2) economic or consumer action such as environmental NGOs. (3) minimising or resolving environmental concerns or issues, (4) participating in politics by casting an election, lobbying for policy to address environmental concerns, and (5) taking legal action to enforce current laws
Ecological behavior	Actions and Choices		recycling, reducing waste, conserving energy and water, supporting organic and local food production, practicing responsible tourism, and advocating for environmental policies

Sustainable behavior	Action and choices		energy conservation, waste reduction, responsible consumption, ethical sourcing, supporting renewable energy
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RQ2: Challenges to develop pro environmental behavior among middle school students.

Social: community engagement, gender & ecological value of parents

Developing PEBs addressing various challenges including challenging the community engagement between school and academic community (Gallay et al. 2021; Maurer et al. 2020; Mercer et al. 2017) and a decreased focus is placed on the personal aspects of primary and secondary education curricula (Lovren & Jablanovic, 2023). The challenge of each gender's relationship to the environment may have an impact on how conscious they are of climate change (Arı & Yilmaz, 2017; Eze, 2020; Nepras et al. 2023). Moreover, ecology values of parents, it has been discovered that perceived parental values might help predict children's behaviors from early childhood through young adulthood, including academic and social behaviors (Jančius et al. 2021; Scopelliti et al. 2022).

Economy: cost of environment products & lack of resources

Cost of the environment from various perspectives; choosing environmentally friendly products at grocery stores (Baierl et al. 2021; Wang et al. 2022), buying locally produced products or groceries without chemical fertilisers or pesticides (Dela Peña et al. 2018; Wang et al. 2022) invest in more eco-friendly food (Nepras et al. 2023). Meanwhile, lack of resources with various perspectives due to; excessive resource use in nations with large population densities, earth's natural resources are unevenly distributed (Liang et al. 2018); water resources (El Batri et al. 2019; Yusliza et al. 2020), and digital resources (El Batri et al. 2019) and balancing the use of natural resources such fossil fuels, monetary reserves, and the supply of electricity (Janakiraman et al. 2021)

Individual: lack of awareness & lack of motivation

Similarity with several studies: lack of awareness among middle school students due to lack of knowledge about the environment and its related issues (Kellberg et al. 2023; Baierl et al. 2021; Liang et al. 2018), conserving water, protecting the ecosystem from pollution, and protecting the forest from fires (El Batri et al. 2019) and climate change (Brumann et al. 2022; Eze, 2020). School (Liang et al. 2022; Zhang et al. 2023; Dela Peña et al. 2018) and multiculturalism (List et al. 2020) are two issues that affect pupils to have awareness. Increasing children's awareness in chaotic situations is important because, despite the challenges, schools as well as teachers may still help kids develop pro-environmental habits and behaviours (Liang et al. 2022). Motivational concerns are also an outcome of high school pupils' disinterest in studying local and global environmental issues (Brumann et al. 2022; El Batri et al. 2019; Janakiraman et al. 2022; Keith et al. 2021; Kellberg et al. 2023; S. W. Liang et al. 2018; Maurer et al. 2020; Schüßler et al. 2019; Sieg & Dreesmann, 2021). This, in turn, significantly decreases their motivation, desire to engage in eco-responsible behaviour as well as their acquisition of environmental knowledge that is pertinent to the science curriculum.

Cultural: school culture & teaching material

According Schneiderhan-Opel & Bogner (2020), Canlas et al. (2021), Millaku et al. (2023), school culture or real school environment also one of the challenges to develop PEBs. School culture's challenges involve various perspectives; Teaching Green Buildings (TGBs) by Cole & Altenburger (2019) and Liang et al. (2022), role model by Liang et al. (2022) and school should enhance cognitive, motivational, and behavioral competences of students by List et al. (2020). The development of an educational tool to be known as the Climate Change Book Series (CCBS-US) (Sigit et al. 2022) has been discovered to be one of the teaching resources (Sieg & Dreesmann, 2021). A novel approach to green school design that employs sustainable practises in the "teaching tools" of green school buildings (United States Green Building Council, 2008), is producing specialized schools that serve as excellent research facilities for investigating how green buildings and environmental education (EE) interact. Second, according to Cole & Altenburger (2019), that implementing this method in educational settings will help students become more interested in topics like human-ecosystem interactions, building science, and the art of architecture. Finally, teachers must be mindful of their responsibility as role models in the classroom with the goal of motivating students to adopt pro-environmental behaviors. The teachers' encouraging examples proved to be the one factor that had a significant impact on the students' pro-environmental behavior; in other words, the children's environmental awareness and adoption of pro-environmental behaviors significantly increased when teachers picked up trash in front of the students (Liang et al. 2022)

RQ3: Strategies to develop pro environmental behavior into the classroom.

From the analysis of 33 studies, 22 studies used appropriate teaching aids and methods while 19 studies used learner-centered arrangements. An eye has been focused on one of the significant research by Sigit et al. (2022) conducted on creating instructional materials based on students' learning requirements connected to climate change. Other than that, strengthen the teaching strategies, go into teaching resources with appropriate additional materials, and of course provide the teachers environmental issues training (El Batri et al. 2019; Jančius et al. 2021; Canlas et al. 2021; Millaku et al. 2023; Huoponen, 2023). In additional, from the analysis of 33 studies, 11 studies used outdoor program education (Schneiderhan et al. 2020) or outdoor classroom activities such as modern socio-scientific museum exhibitions (Kellberg et al. 2023), that emphasize "critical" or "agential" exhibitions. The major goals of "critical" exhibitions are to promote discussion, decision-making, and an awareness of socio-scientific concerns. "Agential" displays offer good chances for students to participate in environmental activities and be recognized as environmental and political players while also more directly engaging viewers to act on a personal, family, or societal level.

Second, the project involved pupils who looked after bumblebee colonies (Sieg & Dreesmann, 2021). With a moderate effect size, participation in the bumblebee project successfully boosted student willingness for pro-environment, bumblebee-friendly activity. Educational games can help kids become more environmentally conscious. To initially educate elementary school students with the effects of demand and supply of items on the environment, the Gummy Bear Supply Chain (GBSC) game was created as an educational game (Mercer et al. 2017). The instructional game challenges students to assess how a well-known consumer good affects the environment. The reward program (Zhang et al. 2023), green school (Cole & Altenburger, 2019) and green lifestyle (Eze, 2020) are appropriate strategies that can contribute to developing PEBs.

Conclusion

Changing behaviors is not easy. It might be simpler for teachers to focus students' actions, choices, and beliefs in context with the definition given for PEBs. Increasing students' action, choice, and belief may be a more practicable starting point for teachers in the field of science since changing students' behaviors is challenging. The most mentioned strategies, appropriate education tools and methods, and learner-centered arrangements should all be used in tandem to address the biggest obstacles, as shown by the research, which include school culture, lack of awareness, and lack of motivation.

Recommendations

An essential objective of environmental education is the integration of methods to teaching aids and resources, learner-centered arrangements, and outdoor program instruction or outdoor activities in the classroom. This should receive specific attention in science education. Therefore, focus should be placed on considering all factors as holistic in influencing of the pro environmental behaviors developed. Again, among suggestions for activities or strategies that can be carried out must consider the action, choice, and belief of students from time to time, and the challenges by four main factors: social, economy, cultural and individual. Therefore, fostering pro environmental behaviors of middle school students in relevant to the respective communities, where students can learn and be in touch with their local environment, feeling connected to nature and indirectly related to the daily life phenomena.

Limitations

There are three limitations to this study. The database is the first thing to mention, and it consists of Google Scholar, Web of Science, SCOPUS, Taylor & Francis, and SpringerLink. The second is that various countries and contexts have unique problems, solutions, and difficulties in promoting environmental behavior. It specifically uses pro-environmental behavior as a predictor, which is a third limitation. Other predictors, such adopting a green lifestyle, and being committed to the environment, can also predict the development of pro environmental behaviors. Despite these limitations, the findings and discussion of this study could serve as a stimulus for further study of the valuable components of environmental education, as well as for policymakers in developing strategies to close existing gaps between domains to promote the development of learning outcomes.

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