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Environmental Literacy and Pro-Environmental Behavior of Pre-Service Science Educators: The Mediating Effect of Their Climate Change Awareness

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Abstract
The study investigated at how climate change awareness mediates the relationship between environmental literacy and pro-environmental behavior among pre-service science educators in the Davao region, involving a total of 305 respondents. A descriptive-correlational approach was used in a non-experimental quantitative research design. The findings revealed that pre-service science educators exhibit high levels of pro-environmental behavior, environmental literacy, and climate change awareness. This finding highlights the important role of future science educators in disseminating knowledge about climate change, as persons with higher levels of environmental literacy are more likely to engage in pro-environmental actions. Climate change awareness functioned as a partial mediator, indicating that although environmental literacy is essential, climate knowledge enhances educators' involvement in sustainable practices. The findings underscore the essential function of prospective science educators in climate advocacy, indicating that educational programs may improve environmental literacy curricula and incorporate discussions on climate change, thus preparing future teachers to motivate responsible environmental actions in their communities.

Keywords: pro-environmental behavior, environmental literacy, climate change awareness, pre-service science educators, Philippines

1. Introduction

Over the past few years, the severity of climate-related issues has escalated, presenting a significant risk to both human life and existence. As reported by UN Climate Change News, in 2020, approximately 30 million individuals were displaced from their homes due to climate-related events. Moreover, in 2021, extreme weather events resulted in insured losses totaling around USD 120 billion. Given the prevalence of numerous environmental challenges, there is a growing focus on addressing these issues and enhancing environmental sustainability. Ultimately, it is recognized that human behavior lies at the root of environmental problems [17].

Environmental problems in the world do not have permanent solutions. It was necessary to make it possible for future generations to identify these issues and offer or recommend solutions. Since the world population is increasing in number, the needs and the wants of the people also increase. The

connection between attitude and behavior is not always clear. Some positive environmental attitudes, would lead to pro-environmental behavior that reduces environmental impacts and has positive environmental outcomes. To address these issues, a growing number of scientists, organizations, and individuals globally are advocating for immediate and substantial shifts in human behavior and the widespread adoption of eco-friendly technologies to protect the Earth's life support systems [3, 18].

Individual behavior is shaped by a complex network of interconnected elements. Attitudes, values, convenience, social influence, cost-benefit considerations, accessibility, awareness of the consequences of one's actions, perceived responsibility, self-confidence, and various other factors collectively influence behavior. Given the intricate nature of human behavior, this study will conduct a thorough review of existing literature, emphasizing empirically established influences on individual environmental behavior, rather than dissecting its individual components (Parker, 2019). In the new global economy, depletion of natural resources has become a central issue. One of the greatest challenges of the twenty-first century is the conservation of natural resources. There is a need for a shift in mind-set and reversal of the existing trend among the government, organizations, and people as said by Fatoba & Aladejana (2014) in one of their studies [4, 12].

Humans and the environment are interconnected and have an impact on one another. Human activity has an impact on sustainable living, both directly and indirectly. Humans' excessive use of natural resources without regard for the environment's carrying capacity or ecological functions contributed to the decline in environmental quality. To ensure the survival of living things and the preservation of ecosystems, natural resource management must be done wisely, appropriately, and consistently. An important factor in raising students' awareness of environmental issues is their level of environmental literacy (EL). Increasing students' environmental literacy is one of the environmental education's ultimate goals. The integration of EL into environmental education helps students understand how the environment and the natural world relate to people. EL is the capacity to protect the environment and find solutions to environmental issues. According to the Environmental Education and Training Partnership, EL is the capacity to resolve current environmental issues while preventing the emergence of brand-new ones [3].

According to Gao's (2018) study, attitudes and environmental literacy have the power to successfully and favorably affect behavior. In particular, persons who are more ecologically literate and have more positive views about the environment also tend to act in ways that are more environmentally sensitive. Additionally, environmental literacy has the biggest influence on these behaviors [16]. Similar to this, Panjaitan et al. (2020) stress the urgent need for environmental literacy and point out that its significance is becoming more widely acknowledged. Nevertheless, there is still a gap in its application in spite of this recognition. Data demonstrating that some kids are still not receiving environmental literacy training serve as evidence for this [5, 11]

Pro-Environmental Behavior (PEB) is a term that encompasses the conscious actions taken by individuals to reduce their impact on the natural environment. These actions involve a range of efforts such as using fewer natural resources, avoiding harmful toxins, generating less waste, and conserving energy. The concept of PEB underscores the importance of individual responsibility in contributing to environmental sustainability. Despite the progress made by Environmental Education (EE) in raising awareness about various environmental issues and forms of pollution on a global scale, there is a common phenomenon known as "action paralysis." This phenomenon refers to the belief held by many individuals that their actions, beyond basic efforts like recycling, cannot significantly contribute to

environmental improvement. This skepticism often leads to a lack of proactive engagement with environmental issues [19].

Parker (2019) conducted an in-depth analysis of existing literature which examines proven methods for promoting individual pro-environmental behavior (PEB). It highlights the significance of environmental education (EE), particularly when introduced at a younger age and continued for extended periods. Another central emphasis is placed on informal environmental education (EE) due to its demonstrated effectiveness, which surpasses that of formal EE in isolation. Additionally, the connection to nature has been identified as a predictive factor for pro-environmental behavior (PEB). Her study indicates that expanding one's interactions with the natural world leads to an enhanced sense of connection to nature, which, in turn, positively influences pro-environmental behavior (PEB). This effect is notably beneficial when introduced during a person's formative years, particularly in childhood [12].

There are several studies on climate change awareness. In one of the study of Luthfia et al, (2022) which is about examining the youth's role in strengthening the public's climate change awareness, their study was conducted through descripted qualitative approach. Using interviews, documentation and observation the data was gathered. And the data shows that Youth for Climate Change (YfCC), a group of youth in Yogyakarta, with the use of educational approach, YfCC played various important roles in strengthening the public's awareness on climate change. However, even if they have those significant roles, they did not get enough support from their government [10].

In view of the severe effects felt all around the world, the term "climate change" has entered the vernacular in the past decade. People think that stronger typhoons, heavier rain, wetter months, hotter dry months, unpredictable weather, higher temperatures, and sea level rise are now the norm. But understanding the effects of climate change does not equate to understanding the science underlying it. Having a deep understanding of the scientific explanation of climate change will empower humans to effectively confront and adapt to climate change. Although Filipinos are often resilient, climate change is an undeniable phenomena that must be acknowledged and understood via rigorous scientific explanation and evidence, even if it cannot be completely ceased [15].

In the Philippines, the majority of people are aware of the dangers posed by natural calamities, but only around one-third actively prepare for them, according to Bollettino's (2020) study [2]. According to his research, people's readiness is influenced by their own experiences with the effects of climate change, which motivates them to prepare for emergencies and strengthen their homes. Proactive community involvement in climate change adaptation and mitigation is encouraging, as it promotes well-informed decision-making. Lopez and Malay's (2019) study supports this positive change by demonstrating that senior high school students in the Philippines are becoming more conscious of climate challenges and feel a strong sense of obligation to contribute to the solution. This suggests that young people are becoming more committed to taking action on climate change [9].

The theoretical framework of this study draws upon the theory of planned behavior, an expansion of the theory of reasoned action developed by Ajzen and Fishbein in 1980 [1]. The theory of planned behavior was formulated to address the inherent limitations of the original model, particularly concerning behaviors that individuals do not have full control over. This theoretical framework provides a structured lens through which to examine and understand human behavior, particularly those actions influenced by both individual intentions and external factors. It acknowledges that people often encounter situations where they have incomplete volitional control, and it seeks to account for these complexities. To streamline the theoretical model and ensure clarity, the theory omits the consideration of potential

feedback effects of behavior on the antecedent variables, focusing primarily on the predictive power of attitudes, subjective norms, and perceived behavioral control in shaping behavioral intentions. This framework serves as the foundational structure for our study, offering a lens through which we can explore the determinants of pro-environmental behavior, given the multifaceted and partially uncontrollable nature of such actions.

The relationship between environmental literacy, climate change awareness, and pro-environmental behavior is the main focus of this study's conceptual framework. Environmental literacy is the independent variable that is thought to affect pro-environmental behavior. It is measured in three ways, cognitive (knowledge of environmental concepts), affective (emotional connection to environmental issues), and behavioral (actual environmental actions). A thorough grasp of students' environmental literacy is made possible by this extensive evaluation, which covers their knowledge, emotional connection, and practical participation [8]. The dependent variable, which is pro-environmental behavior, is broken down into private and public actions based on the signs used by Mateer et al. (2022). These actions include things that individuals do to help the environment. As a mediating variable, climate change awareness connects environmental literacy to actions that are good for the environment. It is made up of four parts: education (knowledge and information about climate change), public sources (influence from the media and public campaigns), personal experiences (observations of the climate by individuals), and government actions (perceptions of government climate policies). Each of these shapes environmental engagement.

Conceptual Framework

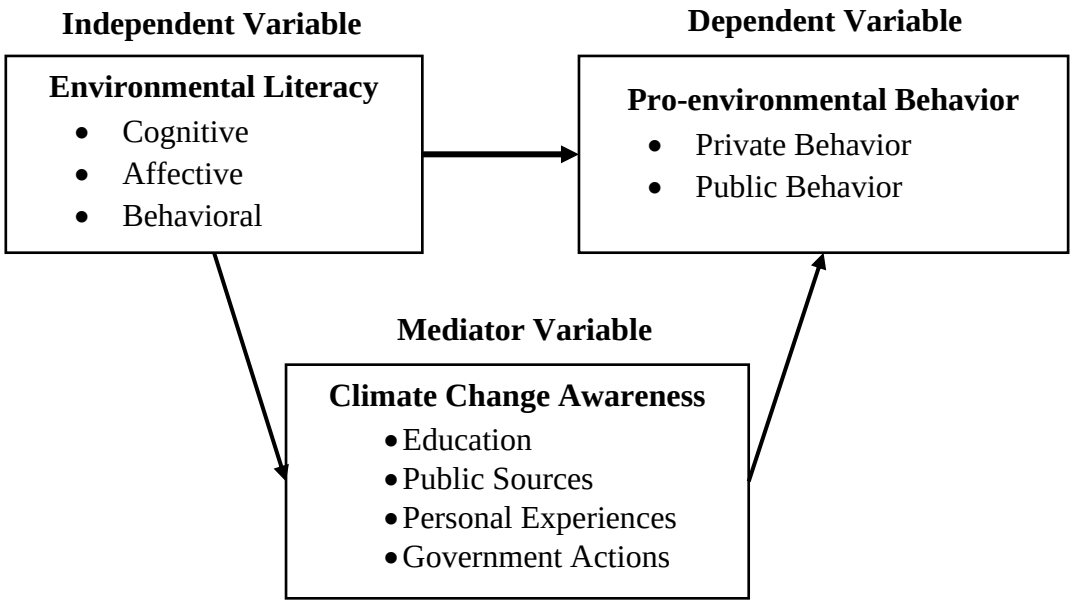

Figure 1. Conceptual Framework of the Study

The objective of this study is to determine the students' behavior towards pro-environmental by knowing their level of environmental literacy and to know the mediating effect of climate change awareness. The first research objective is to know the level of environmental literacy of the Pre-service Science Educators' in terms of cognitive, affective and behavioral aspects. Second research objective is about determining the behavior of the Pre-service Science Educators' towards pro-environmental in terms of

private behavior and public behavior. Third research objective is to determine the mediating effect of climate change awareness to the students' pro-environmental behavior in terms of education, public sources, personal experience and government actions of climate change. And the fourth research objectives is to know the significant relationship between environmental literacy and pro-environmental behavior of students; climate change awareness and pro-environmental behavior of students; and the environmental literacy and climate change awareness of the students. The hypothesis in this study is derived from the preceding literature which is the students' awareness in climate change mediated the relationship between pro-environmental behavior and environmental literacy of the students.

The significance of this study is to address major environmental and ecological issues, it is very important to educate and train students to improve their environmental literacy and pro-environmental behavior. A solid foundation in environmental literacy should be required to prepare scientifically literate citizens capable of responsibly contributing to a more sustainable society. This research has implications for the design and development of introductory environmental courses in college and university. An introductory environmental course that places a high value on environmental literacy would give students the chance to develop the knowledge, awareness, and attitudes necessary for them to make decisions that have a positive impact on the environment. This study supports Sustainable Development Goal (SDG) 13 by emphasizing the important role of climate change awareness in addressing and mitigating the effects of climate change. It is essential to increase the knowledge of climate change among future educators in order to develop a generation that is well-equipped to participate in global climate action. This will help achieve the goal of SDG 13, which is to enhance climate change education and encourage sustainable practices [3].

2. Method

Research Respondent

The participants in this study were the students who are taking Bachelor of Secondary Education with specialization in Sciences or also called as Pre-service Science Educators. These are students from various colleges who are enrolled in the first semester of the school year 2023-2024. The population of the study covered all students from the UM Tagum College (UMTC), Arriesgado College Foundation, University of Mindanao (main campus), and UM Digos College.

Materials and Instrument

Three sets of questionnaires, each based on previously published scientific literature, were chosen to measure each of the study's variables in accordance with the research objectives. The pro-environmental behavior questionnaire, which has been adapted from Mateer et al. (2022), comprises 14 items that are categorized into private and public behavior indicators. The Liang et al. (2018) environmental literacy questionnaire has 58 questions that cover cognitive, affective, and behavioral factors. Last but not least, the climate change awareness questionnaire, which was developed from Gazzaz and Aldeseet (2021), consists of twelve questions scattered across four indicators: education, public sources, personal experience, and actions taken by the government. A group of knowledgeable individuals conducted an analysis of the content validity of these items, and they reached a consensus of at least eighty percent about its appropriateness, relevance, and language. Following the incorporation of feedback from experts, the instruments were pre-tested on twenty undergraduate students who were chosen at random. The instruments were then subjected to item analysis for difficulty and discrimination, as well as component analysis, which was used to finalize the questionnaire items [6, 8,]

Design and Procedure

Using a descriptive correlational research approach, this study investigated the behavior of pre-service science educators toward activities that are beneficial to the environment. This was accomplished by evaluating the pre-service teachers' environmental literacy as well as the function that climate change knowledge plays as a mediator in influencing these behaviors. According to Sar, Apat, and Pareja (2023), descriptive correlation is a quantitative technique that enables the description of current attitudes, activities, and feelings among a population. Psychology is one of the domains that has proved the effectiveness of this technique [13]. The analysis of data was performed utilizing IBM SPSS, applying a 95% confidence level and an alpha of 0.05 for the correlational analysis. Descriptive and inferential statistics, including mean, standard deviation, and frequency percentages, were employed to assess the personal characteristics of respondents and their overall scores in environmental literacy, pro-environmental behavior, and climate change awareness [14]. Furthermore, the Pearson Product Moment Correlation was utilized to analyze the connection between environmental literacy and pro-environmental behavior.

To deepen the understanding of the mediating effect of climate change awareness, the study utilized the Med graph and Sobel z-test, along with Baron and Kenny's Mediation Test (1986). MacKinnon, Fritz, and Fairchild (2007) describe mediation as the process by which a third variable affects the relationship between independent and dependent variables. The Mediation Test elucidated the extent to which awareness of climate change influences the connection between environmental literacy and pro-environmental behavior. When the mediator (climate change awareness) has a substantial impact on the dependent variable (pro-environmental behavior), it may diminish or eliminate the influence of the independent variable (environmental literacy), highlighting a significant mediating function in the ultimate regression analysis.

In the pursuit of this study, a rigorous commitment to ethical standards was of paramount importance. Given that human participants were involved, a comprehensive set of ethical considerations was rigorously adhered to. Firstly, informed consent was diligently obtained from all participants, ensuring that they were fully aware of the study's objectives, procedures, potential risks, and benefits and that their participation was entirely voluntary and could be withdrawn at any time without consequences. The principles of anonymity and confidentiality were strictly upheld, safeguarding the privacy of participants and ensuring that any data collected was devoid of identifying information. Moreover, any potential harm or discomfort was minimized, and participants were not exposed to undue stress or harm.

3. Results and Discussion

Level of Environmental Literacy of Pre-Service Science Educators

Table 1 illustrates the level of environmental literacy of the pre-service science educators. Every indicator offers a unique perspective for assessing pre-service science educators' environmental literacy. The data presented in Table 1 reveals an overall mean score of 4.24, which signifies a notably high level of environmental literacy among the participants surveyed. The cognitive indicator demonstrates a significant level of factual knowledge and understanding of environmental issues, achieving a mean score of 4.17. In a similar vein, the behavioral indicator, which also received a score of 4.17, evaluates individuals' engagement in sustainability and environmental conservation efforts, highlighting opportunities for enhancing the application of knowledge into tangible actions. The affective indicator

shows a mean score of 4.36, indicating a robust emotional connection to environmental issues and a favorable attitude towards environmental care.

The findings support Eberly's (2021) study, emphasizing the dedication of Pre-service Science Educators to environmental literacy, which is crucial for incorporating environmental concepts into classroom teaching and encouraging sustainable practices among students. The research further supports the assertion made by Parwati, Redhana, and Suardana (2020) that environmental literacy includes an individual's understanding, perspective, and capability to tackle environmental challenges. Panjaitan et al. (2020) acknowledge the significance of environmental literacy; however, they highlight a gap in its implementation, noting that some children do not receive instruction in this crucial area. Developing an understanding of environmental issues and fostering positive attitudes in students can promote respect for natural resources and encourage responsible stewardship, with educational programs designed to deliver thorough knowledge on these topics [3, 11,]

Table 1: Level of Environmental Literacy of Pre-Service Science Educators

Indicators	SD	Mean	Descriptive Level
Cognitive	0.45	4.17	High
Affective	0.35	4.36	Very High
Behavior	0.44	4.17	High
Overall	**0.33**	**4.24**	**Very High**

Level of Pro-environmental Behavior of Pre-Service Science Educators

The findings presented in Table 2 reveal that individuals demonstrated a significant level of pro-environmental behavior, highlighting notable differences between their private and public spheres. The mean score of 4.27 indicates a significant level of engagement in environmentally friendly behaviors within private contexts, implying that respondents are actively incorporating sustainable practices into their everyday lives. The mean score of 3.94 indicates a strong, albeit somewhat moderate, level of engagement in pro-environmental actions within public settings, encompassing behaviors performed in communal space. Nonetheless, the overall mean score of 4.11 indicates a significant level of pro-environmental behavior in both areas, despite the noted discrepancy. In alignment with these findings, Hoffmann and Muttarack (2020) emphasize that formal education plays a crucial role in enhancing pro-environmental behavior by augmenting individuals' skills, knowledge, and awareness concerning actions designed to address climate change. This indicates that although people might emphasize sustainability in their personal lives, there remains an opportunity to enhance the application of these practices in communal or public contexts. The findings suggest that participants exhibited a notable level of pro-environmental behavior, demonstrating a positive attitude towards environmental conservation and sustainability efforts [7].

Table 2: Level of Pro-Environmental Behavior of Pre-Service Science Educators

Indicators	SD	Mean	Descriptive Level
Private Behavior	0.53	4.27	Very High
Public Behavior	0.77	3.94	High
Overall	**0.55**	**4.11**	**High**

Level of Climate Change Awareness of Pre-Service Science Educators

Table 3 presents data indicating a remarkably high level of awareness about climate change among respondents across a number of indicators. The mean scores for education, recorded at 4.53, and public sources, at 4.55, are particularly significant. This suggests that respondents have cultivated a robust comprehension of climate change through formal education and information obtained from public sources such as media and scientific publications. All indicators demonstrate a consistently high level of awareness, categorized as "Very High." Furthermore, personal experiences, averaging 4.41, along with governmental actions, which average 4.35, significantly influence the awareness of respondents. The pre-service science educators demonstrate a robust understanding of climate change, as evidenced by their overall mean score of 4.46, indicating a thorough comprehension of the topic from multiple perspectives. This comprehensive understanding illustrates their preparedness to tackle and respond to the challenges presented by climate change. The data reveals a favorable trend in active community engagement aimed at addressing and adapting to climate change, alongside informed decision-making processes.

Bollettino (2020) underscores a notable discrepancy between awareness and preparedness for disasters in the Philippines, indicating that while there is a broad recognition of natural hazards, merely a third of individuals engage in proactive measures to prepare for them. This study highlights the connection between individual experience and preparedness for disasters, indicating that individuals who have been directly affected by climate change are more inclined to engage in proactive measures, such as emergency planning and fortifying their residences against potential disasters. Moreover, the data reveals an increasing trend of communities taking part in climate change initiatives, which includes both mitigation and adaptation efforts. In addition to these findings, a study by Lopez and Malay (2019) highlights encouraging advancements in climate awareness among Filipino senior high school students. These students not only grasp the complexities of climate change issues but also exhibit a sense of responsibility towards contributing to potential solutions. The pronounced sense of responsibility exhibited by the younger generation indicates a notable transformation in their awareness and involvement regarding climate change, implying their readiness to take initiative and back endeavors aimed at addressing this critical issue [2, 9].

Table 3: Level of Climate Change Awareness of Pre-Service Science Educators

Indicators	SD	Mean	Descriptive Level
Education	0.52	4.53	Very High
Public Sources	0.46	4.55	Very High
Personal Experience	0.53	4.41	Very High
Government Actions	0.71	4.35	Very High
Overall	**0.40**	**4.46**	**Very High**

Significance on the Relationship between Environmental Literacy and Pro-Environmental Behavior of Pre-Service Science Educators

The findings in Table 4 show a strong positive correlation between pro-environmental behavior and environmental literacy in all domains. Increased engagement in private conduct ($r = 0.235$, $p < 0.01$), public behavior ($r = 0.148$, $p < 0.01$), and total behavior ($r = 0.216$, $p < 0.01$) is specifically correlated with higher levels of cognitive environmental literacy. Affective environmental literacy also has a high

positive connection with behavior in public ($r = 0.200$, $p < 0.01$), private ($r = 0.450$, $p < 0.01$), and total ($r = 0.356$, $p < 0.01$) domains. Additionally, behavioral environmental literacy has the strongest correlations with pro-environmental acts in private ($r = 0.512$, $p < 0.01$), public ($r = 0.461$, $p < 0.01$), and total behavior ($r = 0.567$, $p < 0.01$) domains.

The study of Hastuti et al. (2024) also have same significant findings indicating that pro-environmental behavior is strongly shaped by several key factors. These include environmental knowledge, which enhances understanding of ecological issues and environmental responsibility. Consequently, it is essential that environmental education (EE) programs undergo comprehensive and regular evaluations that encompass all facets of environmental literacy (EL), including the factors that contribute to promoting pro-environmental behavior (PEB). By adopting a systematic approach, EE programs can aim to cultivate an environmentally literate generation that not only comprehends environmental challenges but also demonstrates proactive engagement in conservation efforts, as supported by Wong et al. (2018) [19].

Table 4: Significance on the Relationship between Environmental Literacy and Pro-Environmental Behavior of Pre-Service Science Educators

Environmental Literacy	**Pro-Environmental Behavior**		
	Private Behavior	Public Behavior	**Overall**
Cognitive	.235**	.148**	.216**
Affective	.450**	.200**	.356**
Behavior	.512**	.461**	.567**
Overall	**.485****	**.338****	**.469****

Significance of the Relationship between Climate Change Awareness and Pro-Environmental Behavior of Pre-Service Science Educators

The strength and direction of this relationship between various aspects of pro-environmental behavior, such as private behavior, public behavior, and overall behavior, and various dimensions of climate change awareness, such as education, public sources, personal experience, and government actions, are revealed by the correlation coefficients. As shown in Table 5, the findings show strong positive associations between pro-environmental conduct and awareness of climate change. More specifically, there is a substantial correlation between higher degrees of education-related climate change knowledge and higher levels of participation in pro-environmental actions, both in the public and private spheres, as well as total pro-environmental behavior. Similarly, awareness of climate change that comes from public sources significantly correlates with several pro-environmental behavior dimensions, emphasizing the influence of informational sources on behavior.

The links between individual climate change awareness and pro-environmental behavior provide evidence of the critical role that firsthand experiences play in promoting environmentally conscious attitudes and behaviors. Significantly, there are strong correlations between governmental initiatives and particular pro-environmental behaviors, highlighting the influence of educational and informational strategies on the motivation of pre-service science educators to participate in sustainability efforts (Nesperas, 2023). In support of this, Hwang, Lee, and Jang (2024) discovered that awareness of climate change has a positive influence on the intentions of sports spectators to reduce single-use plastics, with subjective norms acting as a mediator. Similar to this, Nepras et al. (2023) found that climate views and

pro-environmental behavior differ depending on the context, highlighting the necessity of cross-cultural research to better understand these dynamics. These studies collectively support the implementation of focused strategies to improve environmental awareness and promote action within various educational and societal contexts.

Table 5: Correlation between Climate Change Awareness and Pro-Environmental Behavior of Pre-Service Science Educators

Climate Change Awareness	Pro-Environmental Behavior		
	Private Behavior	Public Behavior	**Overall**
Education	.424**	.481**	**.538****
Public Sources	.390**	.275**	**.379****
Personal Experience	.300**	.084	**.202****
Government Actions	.157**	.133*	**.167****
Overall	**.417****	**.320****	**.423****

Influence of Environmental Literacy on Pro-environment Behavior as Mediated by Awareness towards Climate Change

The results of the regression analysis that examined the intricate relationship between respondents' environmental literacy, awareness of climate change, and pro-environmental behavior are shown in Table 6 below. The analysis proceeds in multiple steps, each of which clarifies a different aspect of this link. First, the direct relationship between environmental literacy and pro-environmental behavior is investigated, and the results indicate a strong positive correlation. Consequently, a strong positive correlation between environmental literacy and awareness is shown upon the inclusion of climate change awareness as a mediator variable. Furthermore, the data shows that the relationship between environmental literacy and pro-environmental behavior is considerably mediated by awareness of climate change. Even after controlling for the mediator variable, there is still a statistically significant direct correlation between environmental literacy and pro-environmental behavior, but with a somewhat smaller effect size.

Table 6: Regression Analysis Showing the Influence of Environmental Literacy on Pro-Environment Behavior as Mediated by Awareness Towards Climate Change

Step	Path	B	S.E.	β
1	c	.779	.084	.469***
2	a	.730	.056	.603***
3	b	.302	.086	.220***
4	c	.558	1.04	.336***

* $p<0.05$

The statistical analysis shown in Table 7 below examines the mediating role of climate change awareness in the connection between pro-environmental behavior and environmental literacy. The study centers on the progression from environmental literacy to an understanding of climate change, culminating in actions that support environmental sustainability. The findings from the Sobel z-test show a z-value of 3.41 and a p-value below 0.05, suggesting notable partial mediation. This indicates that although environmental literacy serves as an essential basis for grasping environmental issues, it is the

awareness of climate change that boosts educators' confidence and perceived ability to participate in pro-environmental actions. This finding is consistent with the work of Hoffmann and Muttarak (2020), who argue that education affects behavior mainly by increasing awareness of human-induced climate change, which in turn enhances self-efficacy in addressing environmental issues. The data highlights the significance of climate change awareness as a vital factor that enhances pre-service educators' confidence in minimizing their environmental impact [7].

Table 7: Mediating Effect of Climate Change Awareness on the Relationship between Environmental Literacy and Pro-environmental Behavior

Combination of Variables	Sobel z	p-value	Mediation
environmental literacy awareness towards climate change pro-environmental behavior	3.406553	<0.05	Partial mediation

** $p<0.05$*

Therefore, educational interventions should prioritize not only enhancing environmental literacy but also raising awareness of climate change and its human-induced causes, thereby better equipping educators to translate their knowledge into actionable behaviors for a more sustainable future. The results of their study further emphasize the significance of having information about the threats posed by climate change, although they may not be able to fully explain the connection between education and environmentally conscious behavior. On the contrary, this heightened consciousness acts as an essential bridge, increasing pre-service teachers' perceived self-efficacy in lessening their environmental impact. In order to better prepare educators to convert their knowledge into practical actions for a more sustainable future, educational interventions should place equal emphasis on increasing environmental literacy and increasing awareness of climate change and its human-induced causes [7].

4. Conclusion

According to the study's findings, pre-service science educators' pro-environmental behavior is greatly aided by their awareness of climate change, with formal instruction on the subject having the greatest impact. This educational foundation significantly encourages both private and public environmentally responsible actions, while understanding received from public sources, such as the media, reinforces these behaviors, albeit to a lesser amount. Individual environmental habits are largely influenced by personal experiences with the effects of climate change, while awareness of government activities has a relatively small impact possibly because people believe that they are indirectly related to personal conduct. Additionally, the association between environmental literacy and pro-environmental behavior is partially mediated by climate change awareness, indicating that awareness amplifies the influence of environmental knowledge on environmental activities. Therefore, it is important to include learning about climate change in environmental literacy classes so that future teachers can better show others how to be environmentally responsible in their personal and public lives.

This study's findings also support the theory of planned behavior, especially in the context of perceived behavioral control, used as a framework to comprehend the impact of environmental literacy and climate change awareness on pro-environmental actions among pre-service science educators. In TPB, perceived behavioral control indicates how comfortable or uncomfortable an individual feels about executing a behavior, influencing their intentions and probability of taking action. This study indicates that elevated

climate change awareness and environmental literacy empower these educators to feel both competent and knowledgeable in participating in pro-environmental actions. Furthermore, the findings suggest that awareness of climate change plays a partial mediating role in the connection between environmental literacy and pro-environmental behavior, indicating that such awareness enhances educators' confidence in pursuing their intentions. This heightened sense of agency, grounded in a solid educational foundation, empowers educators to navigate perceived obstacles and embrace pro-environmental practices in both private and public spheres. As a result, incorporating climate awareness into environmental literacy initiatives can enhance educators' sense of agency, providing them with the necessary tools and confidence to champion sustainable practices in both their personal and professional lives.

In order to make the most of the partial mediation impact that climate change awareness has on the connection between environmental literacy and environmentally conscious behavior, educational institutions ought to make the incorporation of climate change awareness into their environmental literacy curricula a top priority. One way to accomplish this is by engaging them in climate-related classes, seminars, and workshops that focus on addressing current climate challenges and helping students gain a better knowledge of the effects of this global warming. Pre-service science educators should feel more knowledgeable and assured about their capacity to handle environmental challenges by participating in educational programs that prioritize critical thinking and problem-solving techniques. Incorporating experiential learning opportunities, like field trips, community service projects, or collaborations with environmental groups, can also give teachers real-world applications of their knowledge, improving their perceived behavioral control and motivating them to take initiative in both their personal and professional lives.

5. Recommendation

Educational programs must extend beyond curriculum improvement by integrating components that enable teachers to exert greater influence over environmental initiatives within their communities. Programs could provide specialized training sessions that encourage successful pro-environmental habits in personal and public spheres, as well as workshops that tackle prevalent concerns with practical, solution-oriented strategies. Consistent assessment and modification of these activities would enable institutions to obtain critical input from pre-service instructors, enhancing tactics that better address the obstacles they encounter. Moreover, cultivating a collaborative community among pre-service educators like facilitating the open exchange of techniques and experiences that would enhance their confidence and drive to adopt sustainable practices. Executing these recommendations would enhance environmental literacy and awareness in education while preparing future educators to actively and effectively engage in sustainability initiatives.

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