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Environmental Awareness of University Science Students and Its Role in Sustainable Development

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Abstract

Science students play a vital role in the advancement of information and technology; therefore, environmental awareness is a crucial component of sustainable behavior. This study aims to examine the level of environmental awareness among science students and the factors influencing it. A descriptive qualitative approach was employed, with data collected through observations, interviews, and literature reviews. The research respondents consisted of science students from the biology, chemistry, and physics study programs. The findings indicate that science students generally demonstrate a moderate level of environmental awareness, particularly in terms of knowledge. However, this awareness is not yet fully reflected in strong attitudes and consistent pro-environmental behaviors in daily life. Therefore, sustained efforts by educational institutions are necessary to enhance students' environmental understanding and active participation in environmental protection.

Keywords: Ecological Protection, Education on environmental issues, Environmental Awareness, Science Students, Sustainable Development

INTRODUCTION

Environmental issues in the current period are becoming more and more complex. Ecosystem destruction, air and water pollution, land degradation, deforestation, and climate change are just a few of the problems that have a major impact on ecosystem balance and human quality of life (Harahap, Komala, & Ristanto 2020; Xiao et al. 2025; Palma, Depalo, & Curci 2025). This phenomenon requires urgent attention since it not only threatens the sustainability of the power source but also has an impact on public health, social, and economic factors (Harahap, Ristanto, & Komala 2020; Ambrosio et al. 2025). The majority of

environmental issues are intimately linked to human conduct that tends to be exploitative and less mindful of sustainability principles. As a result, a complete effort is required that focuses not only on approaching technology and policy but also on individual development awareness and the environment.

One of the most important elements in the preservation of the ecosystem is awareness. This awareness represents people's capacity to comprehend their surroundings, identify issues that arise, and recognize the effects of every activity on their surroundings (Maza-maza et al. 2025; Thi, Le & Shinjo 2025). In this sense, awareness of one's surroundings encompasses not only cognitive elements in the form of knowledge but also emotive and value dimensions that shape an individual's attitude and how they see their surroundings. People with a high level of environmental awareness are expected to demonstrate responsible attitudes and support various environmental conservation efforts in promoting sustainable development. Sustainable development is a development process that aims to meet the needs of the present generation without compromising the ability of future generations to meet their own needs, while maintaining a balance among environmental, social, and economic aspects.

Education has a critical function in creating and enhancing an atmosphere of awareness (Harahap & Harahap, 2024). People acquire the knowledge, beliefs, and abilities needed to comprehend the interaction between people and the environment through the educational process (Harahap, Komala, & Ristanto 2020a; Saoud et al. 2024). In order to develop a compassionate and responsible attitude toward the environment, environmental education is required to instill awareness from an early age. In the context of high school education, colleges serve not only as hubs for the advancement of information and technology but also as establishments that help students develop their social consciousness and character, including their awareness of environmental issues.

As members of the public education system, students play a crucial role as change agents in a challenging context (Solihin et al., 2025). It is intended that science students in particular, who study a variety of natural phenomena and environmental processes in a scientific manner, will have a higher level of environmental awareness than other members of their group. Science students should be able to use their scientific knowledge to develop a thorough grasp of environmental problems and to encourage the establishment of more responsible attitudes and behaviors in response to environmental challenges.

Therefore, the reality on the ground demonstrates that attitude and behavior-friendly environments are not always directly correlated with height level knowledge. Many people are aware of the necessity of protecting the environment, but many are nevertheless unable to act

consistently in their daily lives. such as continuing to discard trash carelessly, using plastic excessively, and not engaging in the activity environment. The discrepancy between this knowledge and action demonstrates the need for further research on the awareness environment, particularly in student groups. Designing more successful teaching tactics requires an understanding of the amount of awareness of the student environment and the elements that influence it.

According to the description given, it is vital to do a study on awareness in the student environment, particularly for university scientific students. Analysis of the awareness environment is supposed to describe how well pupils comprehend and react to the problem environment, as well as how education plays a significant part in forming awareness.

RESEARCH METHODS

This research uses a descriptive qualitative design. A descriptive qualitative approach is used in this study. Students from science programs like biology, chemistry, and physics in UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan served as the research subjects. Purposive sampling is the method used to collect samples. Techniques for gathering data include: 1) observation to see how students behave in terms of campus sustainability and cleanliness; 2) interviews to determine the degree of students' environmental knowledge, attitudes, and behavior; 3) A review of the literature to support the runway hypothesis and contrast findings with earlier studies.

Dimensions environment awareness according to the Environmental Awareness Ability Measure (EAAM) developed by Jha (1998) in (Shobeiri et al., 2007) includes: 1) causes of pollution, 2) conservation of soil, air, water, and forest, 3) energy conservation, 4) conservation of human health, 5) conservation of wildlife and animal husbandry. The collected data were qualitatively analyzed through data reduction, data presentation, and conclusion drawing.

RESULTS AND DISCUSSION

Students' awareness development follows patterns consistent with the theory of environmental awareness when the five dimensions of awareness environment are applied. These patterns include a shift from awareness-based knowledge (cognitive awareness) to attitude (affective awareness) and finally behavior (behavioral/conative awareness). The stages of internalization awareness that are not yet totally evenly distributed are reflected in the different levels of application in each dimension.

1. Dimensions of Causes of Pollution

Because it is the most straightforward dimension to comprehend and integrate in the early stages of consciousness, pollution occupies first rank. Students frequently deal with pollution-related issues on a daily basis, such as plastic waste, car exhaust emissions, and domestic waste. Environmental awareness theory states that direct contact with a problematic environment raises an individual's cognitive awareness. Students don't need to alter sophisticated behavior in order to recognize the causes of pollution. Consequently, dominance. This dimension demonstrates that students' awareness is still high when it comes to conceptual knowledge and comprehension. The height of the percentage on this dimension is impacted by students' exposure to a lot of knowledge from the media, formal education, and pollution that is relevant to their everyday lives.

2. Dimensions Conservation of Land, Air, Water, and Forests

The dimensions of conservation—land, air, water, and forests—reflect how students' knowledge of stage affective—that is, emergence attitude care to sustainable source Power nature—is developing. This awareness develops as a result of internalizing knowledge acquired via formal education, particularly in scientific courses that address ecosystems and the environment. Students' direct participation in conservation activities is still restricted, despite their attitudes supporting the preservation of the environment. This is consistent with the environmental awareness theory, which holds that a good attitude does not necessarily translate into actual action if it is not backed by firsthand experience and participation opportunities. Students understand how important it is to protect forests, avoid land degradation, and maintain clean air and water. This awareness is demonstrated by attitudes that support environmental preservation and oppose actions that harm the ecosystem, such as logging trees, water pollution, and the accumulation of rubbish that may degrade the land. However, compared to direct participation in activity conservation, its implementation is still more prevalent in the attitude aspect.

3. Dimensions Human Health Conservation

Students' interests and personalities are directly related to the dimensions of conservation health. Students are encouraged to show concern for the environment since they are aware that a clean and healthy environment affects their quality of life. According to perspective theory, environmental awareness that is motivated by self-interest is more likely to be accepted than abstract consciousness. However, this dimension does not yet completely reflect an understanding of a comprehensive ecology because the focus is still human-oriented,

placing humans in the middle of the sequence. Students exhibit a high degree of application. Students understand the connection between a healthy environment and human health, including how air pollution contributes to illness and how important a clean environment is. While not entirely consistent over the long run, this awareness promotes specific behaviors, such as keeping the surroundings tidy.

4. Dimensions Energy Conservation

Dimensions conserving energy demonstrates the difficulty of transforming awareness into sustainable behavior. Everyday habits that are regular and continuous, including conserving electricity and materials burned, are altered by conservation energy demand. Environmental awareness theory states that stage behavior is the most challenging stage to reach because it is impacted by outside variables, including comfort, social norms, and facilities. Even so, kids are aware of the value of energy conservation, such as shutting off lights and equipment when not in use. However, the use of conservation energy is frequently driven by habit and comfort, and it is rarely consistently employed since it is thought to be less useful or to have no obvious effect. Lack of monitoring and control also contributes to this dimension's poor use.

5. Dimensions Conservation Wildlife and Livestock

Dimensions of wildlife, livestock, and conservation life are comparatively far from students' firsthand experiences. Concerns about wildlife protection and sustainable farm management are frequently seen as not being sufficiently addressed by the government or specific groups, rather than by individuals. Students are comparatively less engaged and less willing to apply knowledge of sustainable farm management and wildlife conservation. The low percentage is caused by students' lack of direct contact with animals and livestock, as well as a lack of attention to the subject matter in both formal education and daily life. This dimension usually gets less attention when there is no direct experience or contextual learning. attention in contrast to manmade environmental issues. Theoretically, moral principles and stronger ecological empathy are necessary for environmental consciousness and awareness of non-human creatures. The poor application in this dimension indicates that students' sense of values and ethics is still developing.

Based on the research results, the dimensions that are easiest to understand or apply can be ranked from the dimensions that are most difficult to understand and apply, as follows:

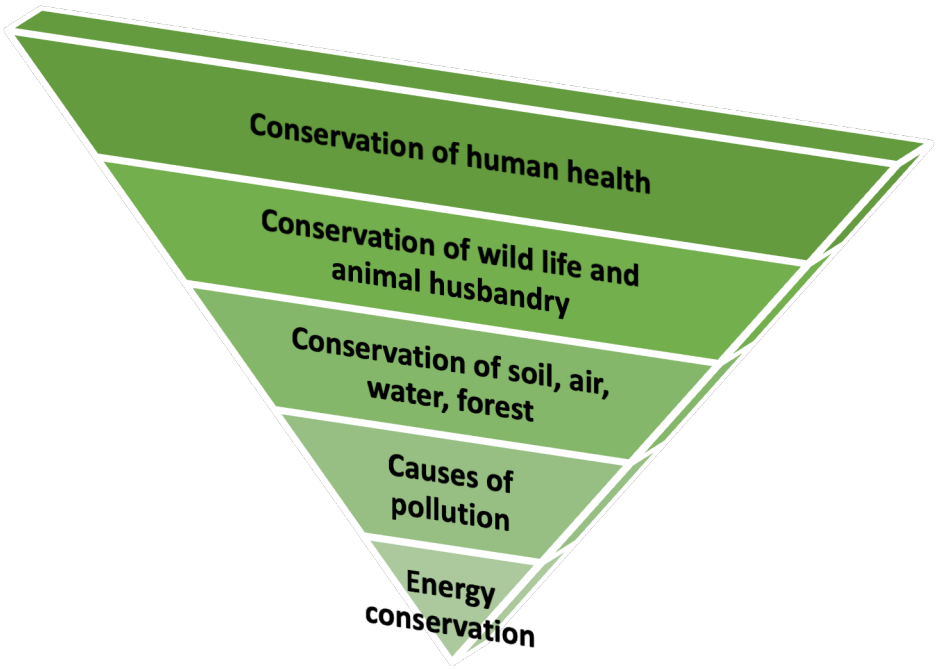

Figure 1. Hierarchy of the Most Well-Understood and Applied Dimensions

The results indicate that students more easily apply dimensions of environmental awareness that are closely related to themselves and to daily life, which are frequently discussed in learning activities. Based on Figure 1, in the first rank, students show a high level of concern for their personal health; therefore, they attempt to protect themselves from exposure to diseases caused by unsanitary environments or food contamination originating from polluted surroundings. In the second rank, students demonstrate strong concern for animals, particularly livestock that can be consumed by humans. Indonesia is a developing country widely known as an agrarian nation. In addition to agriculture, Indonesia relies heavily on livestock as a source of protein and as an economic asset for the community.

In the third rank, students show considerable concern for soil, air, water, and forests, as they understand that damage to these elements can lead to various disasters in society. For example, deforestation can result in landslides, flooding, and rising temperatures. This is followed by the dimension of causes of pollution, where students are highly aware that vehicle emissions significantly degrade air quality. Finally, some students are only aware that excessive use of electricity should be avoided for economic reasons, meaning that higher costs will be incurred if electricity is used excessively, without fully understanding the environmental impacts of such overuse. Indirect and contextual dimensions, such as energy conservation, show a lower level of implementation.

The ranking or hierarchy from the first to the fifth of the dimensions most widely understood and applied is consistent with the findings of studies conducted by (Shobeiri et al., 2007) in India and Iran. The application of the five environmental awareness dimensions by students demonstrates a hierarchical pattern that mirrors the environmental awareness formation process as described in environmental awareness theory. According to this theory, environmental awareness develops gradually, beginning with cognitive comprehension, moving on to the development of affective attitudes, and ultimately showing up as tangible behavior. Variations in the degree of application in each dimension are not random; rather, they are impacted by the issue's proximity to students' lives and the level of information. Variations in the degree of application in each dimension are not random; rather, they are impacted by how close the problem is to students' lives, how much information they are exposed to, and the demands for behavioral change that go along with it. Therefore, to improve the application of environmental awareness comprehensively, materials and activities based on firsthand experience must be reinforced.

CONCLUSION

Students' environmental awareness is still predominantly characterized by cognitive and affective dimensions, while behavioral and value-based dimensions remain insufficiently developed. The dimension most closely related to human health is the easiest for students to understand and implement. This pattern highlights the need for environmental education strategies that go beyond knowledge transfer and place greater emphasis on attitude formation, the development of pro-environmental behaviors, and direct experiential learning through conservation activities. Through such approaches, it is expected that students' environmental awareness can develop more comprehensively and sustainably.

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