

Integration of the global attitudes of prospective teachers in encouraging a culture of environmental conservation for sustainable development in higher education



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Abstract Increasing awareness and positive attitudes toward environmental conservation among prospective teacher students is essential to ensure that future generations understand the importance of sustainability and apply it in their daily lives and educational practices. This study aims to analyze the integration of the global attitudes of prospective teacher students toward the culture of environmental conservation in higher education and its contribution to sustainable development. This study uses a quantitative approach with a survey method involving prospective teacher students from Teacher Professional Education at the State University of Semarang Indonesia. Data analysis revealed that prospective teacher students at Semarang State University have a positive attitude toward environmental conservation, with high scores on the creativity and curiosity indicators. Pearson's correlation test revealed a significant positive relationship between attitudes toward environmental conservation and experiences in environmental action ($r = 0.52, p < 0.01$). The results of multiple regression showed that experience in environmental action ($\beta = 0.45, p < 0.01$) and supporting competencies ($\beta = 0.30, p < 0.05$) had a significant effect on global attitudes toward environmental conservation, explaining 40% of the variance in attitudes. This study provides insight into the dimensions of attitudes that shape the views of prospective teacher students toward environmental conservation and supports the use of this instrument in educational research and conservation policy.

Keywords: experimental, study, science learning, improvement, attitude, university

1. Introduction

Environmental concerns that are becoming more urgent, such as pollution, climate change, and ecosystem degradation, call for coordinated efforts from all spheres of society to promote sustainable practices (Smit et al., 2014). Education, particularly higher education, is crucial for addressing this dilemma since it prints the future for future generations (Raymond et al., 2010). As change agents who will instruct the next generation, student teacher candidates bear an enormous obligation to comprehend the value of environmental conservation and to include it in their everyday lives and teaching methods (Sumarni et al., 2022). It is crucial that aspiring teachers adopt a global mindset to learn and fit into the educational system. A person with a global mentality is one who is conscious of and accountable for global issues, such as the environment, and who is able to successfully act to promote sustainability (Rousta & Jafari, 2024; Tam, 2015). Universities play a crucial role in forming this mindset as centers of learning and intellectual growth through pertinent curricula, comprehensive educational programs, and encouraging extracurricular activities.

Indonesia presents significant problems in maintaining the sustainability of its natural resources and ecosystems because it is a biodiversity hotspot that is also susceptible to numerous environmental hazards (Amran et al., 2019; Jasin et al., 2019). Higher education must respond to these concerns by providing students with the information and abilities necessary to confront and resolve environmental issues (Filho et al., 2018; Rieckmann, 2012). Furthermore, a global mindset that enables students to comprehend how local activities affect global conditions and vice versa must be ingrained in higher education. Higher education students aspir to become teachers (Hénard & Roseveare, 2012). In this sense, they are crucial, particularly in the Teacher Professional Education (TPE) program. Teacher candidates are expected to be able to teach their pupils environmental conservation ideals in the future in addition to being prepared to become competent educators in a variety of



disciplines (Leicht et al., 2018). To guarantee that aspiring teachers can be successful role models and change agents in their communities, strengthening the TPE curriculum's emphasis on global sustainability is crucial.

In addition to imparting knowledge, the development of characteristics and values that promote sustainability is another aspect of integrating global perspectives into the education of aspiring teachers (Lozano et al., 2017; Zsóka et al., 2013). This can be achieved by creating a curriculum that is comprehensive and that integrates environmental knowledge with real-world applications and experiential learning opportunities, including working on environmental conservation initiatives. Furthermore, extracurricular pursuits emphasizing environmental conservation can have a significant effect on how students behave and think (Hebel et al., 2014). Indonesia is in dire need of educators, who can motivate and inspire change toward sustainability because it is a growing nation with many environmental issues (Debrah et al., 2021; Malik, 2018). One of the top universities in Indonesia, Semarang State University, has demonstrated its dedication to lifelong learning. This university's professional education programme plays a critical role in providing aspiring teachers with the information, abilities, and mindset required to help realize the Sustainable Development Goals (SDGs), particularly in the area of the environment. This study assesses the contribution of aspiring teachers to group efforts toward sustainability and investigates how colleges shape attitudes and behaviors related to environmental conservation. As a result, it is anticipated that this research will offer insightful information for the creation of educational practices and policies that are more sensitive to environmental concerns around the world.

1.1. Concept of global wisdom

The value of wisdom is its component, which is recognized as a type of knowledge in accurately evaluating issues pertaining to human existence and conduct (Ardelt, 2004). In the process of using experience and reasoning before acting to solve problems, wisdom theory is implicit as a type of personal quality (Bluck, 2013). Character and knowledge as well as personality and competence are two components that make up the concept of wisdom value (Sulasmono et al., 2017). In actuality, science education integrates culture into problem solving (Zeidler, 2003). Teaching and learning activities are one way in which character education is implemented in schools. Aspects of human rights, integrity, fairness, humility, maintaining order and peace, advancing science and technology, and honoring the confidence of nations worldwide are all part of the 21st-century learning framework of global knowledge (Ang, 2018; Huda et al., 2020). The profile of Pancasila students with one dimension—global diversity—reflects the government's seriousness in bolstering character building. Learning encompasses not only cognitive abilities but also attitudes and behaviors that are consistent with one's identity as an Indonesian citizen and a global citizen (Nurhuda et al., 2023; Zakso et al., 2022). The three primary components of global knowledge in learning are the capacity to speak with citizens worldwide, cultivate local friendships, and apply responsibly. Character development, work culture, and contextual cross-disciplinary initiatives are some ways to put these into practice (Bates et al., 2022). Empirical data demonstrate how crucial it is to comprehend how cultural factors relate to cooperative education, innovative teaching methods, motivating students, fostering empathy, and integrating a multicultural approach into the teaching and learning process. The development of the values, knowledge, and abilities required to create graduate competence requirements will be impacted by these findings (Amzaleg & Masry-Herzallah, 2022). In academics, the value of wisdom is not only in acquiring knowledge but also in adopting a prudent mindset that keeps oneself and others safe (Grossmann et al., 2020).

Six character types—which are further subdivided into 25 distinct value categories—make up the wisdom categorization. These categories are as follows: (1) strength of knowledge and wisdom, which has five characteristics; (2) strength of courage, which has four characteristics; (3) strength of humanity; (4) strength of justice, which has three characteristics; (5) strength of temperance, which has four characteristics; and (6) strength of transcendence, which has five characteristics (Schueller et al., 2015). According to Earley and Peterson (2004), the component of global attitudes is a kind of cultural existence and cultural value of the nation; thus, it is believed that it would be able to retain and preserve them through contextual learning that is holistic and tailored to the times. The feature of global attitudes eventually becomes knowledge that is applied as a source of worth and a life guide when converting information into actual, day-to-day activities. The five types of characters that are used as research targets in the global wisdom framework of this study are as follows: (1) creativity (originality and inventiveness); (2) curiosity (interest, novelty-seeking); (3) open-mindedness (judgment, and critical thinking); (4) love of learning; and (5) perspective. The global wisdom framework draws its sources from Earley & Peterson, 2004.

1.2. Environmental conservation from the perspective of sustainable development

Given the importance of preserving ecosystem balance and safeguarding natural resources for future generations, environmental conservation has emerged as a key theme in international discussions on sustainable development (Holden et al., 2014). The idea of sustainable development has developed over the last few decades into a thorough framework that incorporates social, economic, and environmental factors when developing and implementing policies (Hariram et al., 2023). The preservation, restoration, and maintenance of natural ecosystems, biodiversity, and natural resources—all crucial to the survival of humans and other living things—are together referred to as environmental conservation (Aronson et al., 2006; Rawat & Agarwal, 2015). Environmental conservation is important because it supports human well-being and economic sustainability in addition to protecting the natural world (Braat & de Groot, 2012). Deforestation, pollution, and habitat degradation are

examples of environmental degradation that have been demonstrated to have profound effects on human health, the economy, and social stability. These effects impede efforts to achieve sustainable development (Zhang et al., 2022).

According to Brunseau (2019), sustainable development is development that satisfies current demands without jeopardizing the capacity of future generations to satisfy their own needs. According to Bexell and Jönsson (2017), this idea aims to create a balance between social inclusion, economic progress, and environmental protection. The 17 Sustainable Development Goals (SDGs) that the United Nations (UN) approved in 2015 serve as a summary of the global agenda for sustainable development. Goals 13 (action on climate change), 14 (life underwater), and 15 (life on land) are among those that are directly linked to environmental conservation. These goals are concerned with preserving the environment and lessening the effects of climate change (Carlsen & Bruggemann, 2022). In regard to influencing people's views, values, and actions regarding the environment, education is crucial to environmental conservation initiatives (Sharma & Patel, 2023). In addition to imparting knowledge on environmental issues, environmental education seeks to increase students' ecological consciousness and sense of responsibility (Ariza et al., 2021). To enable people to actively engage in conservation efforts, education that is focused on sustainability should adopt a holistic approach that incorporates cognitive, affective, and practical elements (Hadjichambis & Reis, 2020). From the standpoint of sustainable development, environmental preservation is not only a crucial problem but also a pressing necessity. Attitudes and actions that promote sustainability can be shaped by education, particularly at the postsecondary level (Pacis & VanWynsberghe, 2020). As members of the next generation, student teacher candidates must be well trained to participate actively in environmental conservation initiatives. By effectively incorporating sustainability values and practices into their curriculum, student teacher candidates can work as change agents and help to realize sustainable development goals.

1.3. *Integration of environmental conservation in higher education*

Institutions of higher learning play a strategic role in curriculum development and campus life by including environmental conservation. Students can participate in research, initiatives, and activities that encourage environmental conservation at colleges, which can serve as living labs for sustainability (Wals & Schwarzin, 2012). Numerous colleges in Indonesia have adopted sustainability and environmental conservation-focused curricula, reflecting the country's growing attempts to incorporate environmental education into its higher education system. For example, Semarang State University has demonstrated its dedication by creating a Teacher Professional Education program that places a strong emphasis on the value of environmental preservation in the curriculum for teacher preparation. As aspiring educators, students are responsible for integrating environmental conservation values into their future teaching. The global attitudes of prospective teacher students toward environmental conservation are very important because they are agents of change that can influence the next generation. Previous research has shown that education that integrates the concepts of sustainability and environmental conservation can increase students' awareness and commitment to environmental issues (Corcoran et al., 2017). Teacher education programmes provide students with practical skills and attitudes that encourage conservation efforts in addition to theoretical understanding of environmental conservation. Even though environmental education has come a long way, there are still obstacles to its use in higher education. A primary obstacle is the curriculum's incomplete integration of theory and practice (Bussey et al., 2012). The effective integration of environmental conservation is often hampered by a lack of resources and opposition to changes in academic culture (Scoffham & Rawlinson, 2022). These obstacles can be addressed, however, if higher education institutions make a firm commitment to working together and if all parties involved work together.

2. Materials and Methods

2.1. *Participant*

This study involved participants consisting of prospective teacher students who are registered in the Teacher Professional Education (PPG) program at the State University of Semarang, Indonesia. The inclusion criterion for participants was that they were students who were currently participating in the PPG program and had completed at least one semester of the program. The participants were selected via the purposive sampling technique, which aims to ensure that the participants have relevant experience and background with the research topic. The number of participants in this study was approximately 156 to ensure the representativeness and reliability of the results. Demographic data, including age, sex, educational background, and experience related to environmental issues, were also collected. It is important to understand the social and academic contexts that influence participants' attitudes toward environmental conservation. The participant characteristics are described in Table 1.

Table 1 shows the demographic characteristics of the participants in this study. Among the 156 student teacher candidates, the majority were between the ages of 20–30 years (79.49%), with 67.95% women and 32.05% men being gender representatives. The distribution of educational backgrounds revealed that most of the participants came from science education (37.82%) or social education (36.54%). In terms of supporting competencies related to environmental conservation, 28.21% of the participants had experience participating in environmental action, whereas 27.56% had personal experience managing the environment.

Table 1 Characterization of Research Samples.

No	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
1	Educational Background				
	Science Education	59	37.820	9.501	9.501
	Social Education	57	36.538	9.179	18.680
	Physical Education	34	21.798	5.475	24.155
2	Gender				
	Female	106	67.948	17.069	41.224
	Male	50	32.051	8.052	49.275
3	Age				
	20-30 Years	124	79.487	19.968	69.243
	31-40 Years	32	21.333	5.153	74.243
4	Supporting Competencies				
	Environmental Education Experience	38	24.358	6.119	80.515
	Field Practice Experience	34	21.794	5.475	85.990
	Experience Participating in Environmental Action	44	28.205	7.085	93.076
	Personal Experience Managing the Environment	43	27.564	6.924	100.000

2.2. Procedure

The research procedure is divided into several stages, ranging from preparation to the implementation of surveys and data processing. The research instrument used was a questionnaire consisting of two main parts: (1) participant demographic data and (2) attitude statements that measured participants' global attitudes toward environmental conservation. The questionnaire was developed on the basis of a previous literature review and was tested for validity and reliability through a pilot test with a small group of students who were not included in the main participants. Data collection was carried out for one month. The questionnaire was distributed online via a survey platform that is easily accessible to participants, namely, Google Forms. Each participant was given an explanation of the purpose of the research, and informed consent was obtained before the students filled out the questionnaire. The participants are required to answer all the questions independently without pressure, and their identities are kept confidential to maintain data confidentiality and integrity. After data collection, the next step is data quality control. The data collected are checked for completeness and consistency. Incomplete or inappropriate answers are identified and processed according to established procedures, such as imputing missing data or excluding unqualified respondents from further analysis.

2.3. Data analysis

Data analysis is carried out in several stages to ensure that the research results are valid and reliable. The first stage in data analysis is descriptive analysis, which aims to describe the characteristics of the participants and the distribution of their answers to the attitude statements in the questionnaire. Descriptive statistics such as the mean, standard deviation, frequency and percentage were used to analyze the demographic data and questionnaire answers. The reliability of the instrument was tested via Cronbach's alpha to determine the internal consistency of the attitude statements in the questionnaire. The reliability of the instrument are described in Table 2.

Based on table 2, Cronbach's alpha value above 0.70 is considered adequate. In addition, exploratory factor analysis (EFA) is carried out to ensure the validity of the construct of the instruments used. Before conducting EFA, data feasibility tests are carried out to ensure that the data are suitable for factor analysis. These tests include the following: 1) The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy measures the extent to which variables in the dataset can be grouped into factors. A KMO value greater than 0.60 is considered adequate for factor analysis; 2) Bartlett's test of sphericity. This test tests the null hypothesis that the correlation matrix is an identity matrix. The significance at $p < 0.05$ indicates that the data are suitable for factor analysis. 3) Factor extraction. The factor extraction method used is principal component analysis (PCA) with varimax rotation to identify the main factors that explain the variance in the data. The criteria for determining the number of factors retained are eigenvalues greater than 1 (Kaiser's criteria) and substantial interpretation on the basis of plot scree.

After ensuring reliability and validity, Pearson correlation analysis was used to evaluate the relationships between students' global attitudes toward environmental conservation and other demographic variables. The next analysis involves correlation and regression. This correlation analysis helps understand the extent to which attitudes toward the environment are related to the demographic characteristics of the participants. To evaluate the influence of global attitudes on participation in environmental conservation activities and their contributions to sustainable development, multiple regression analysis was

used. This analysis allows researchers to evaluate the influence of several independent variables simultaneously on the dependent variables. The final stage of data analysis involves the interpretation of the results obtained from various statistical tests. The results are discussed in the context of the literature and reported via tables and graphs to facilitate understanding. Significant findings are interpreted in the context of the influence of global attitudes on environmental conservation culture and its implications for education for sustainable development in higher education.

Table 2 Instrument of the Global Attitude of Student Teacher Candidates.

Aspects	Indicator	No.Item	Mean	Std. Dev
Creativity (Originality and Ingenuity)	Thinking logically about efforts to understand the learning material and knowledge obtained	1	4.20	0.78
	Critical thinking of concepts and the latest knowledge material from what has been possessed before	2	4.15	0.82
	Think creatively in an effort to produce new and up-to-date methods/results from what you have had before	3	4.25	0.76
Curiosity (Interest, Novelty-Seeking)	Positive attitudes and actions in an effort to know more deeply and broadly about what is learned	4	4.30	0.70
	Hard work in overcoming various obstacles in the learning process	5	4.22	0.73
	Confident attitude toward the fulfillment of every wish and expectation	6	4.18	0.80
Open-Mindedness (Judgment, and Critical Thinking)	Students give respect to various kinds of good things such as customs and culture related to the knowledge gained during learning	7	4.10	0.85
	Students' attitudes and actions encourage to produce works and appreciate the works and achievements of others	8	4.12	0.83
	Students are responsible for carrying out every task and obligation to themselves, society and the environment	9	4.20	0.78
Love of Learning	Students show an attitude that is not easy depending on others in completing tasks	10	4.25	0.75
	The way students think, behave and do is based on loyalty, care, and a high appreciation for knowledge	11	4.22	0.77
Perspective	Students show a nationalist attitude in the form of a high appreciation for the nation's language, social, and culture.	12	4.15	0.80
	The attitude and actions of students always try to prevent damage to nature, try to repair, and provide assistance to others, society and the environment	13	4.30	0.72

3. Results

3.1. Validity and reliability of global attitude instruments

Descriptive statistics for each indicator of global attitudes toward environmental conservation are presented in Table 3. The analysis reveals that the average attitude scores for the "creativity" and "curiosity" indicators are relatively high, indicating that prospective teacher students tend to have a positive attitude toward environmental conservation by utilizing students' creativity and curiosity. The Cronbach's alpha score for the overall questionnaire was 0.85, indicating excellent internal consistency. Exploratory factor analysis (EFA) identified five main factors that explain 75% of the total variance, which supports the validity of the instrument's constructs. EFA analysis was carried out to determine the structure of the underlying factors in the global attitude questionnaire toward environmental conservation. EFA aims to identify patterns of relationships between items and factors as well as to evaluate the validity of the constructs of the instruments used in this study. The data feasibility test are presented in Table 3.

A KMO value of 0.87 indicates that the data are very adequate for factor analysis, and Bartlett's test of sphericity shows that the correlation between the variables is significant, supporting the feasibility of the data for EFA. The results of factor extraction via PCA with varimax rotation revealed five main factors that explained 75% of the total variance. The results of the rotation factor are presented in Table 4.

Table 3 Data feasibility test.

Test	Value	Information
Kaiser–Meyer–Olkin (KMO)	0.87	Adequate
Bartlett's Test of Sphericity	$\chi^2(78) = 825.46$	$p < 0.001$ (Significant)

Table 4 Factor Loadings EFA.

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Uniqueness
Item 10	0.742					0.343
Item 7	0.721					0.441
Item 11	0.680				0.420	0.168
Item 8	0.523	0.783			0.781	0.593
Item 9		0.812				0.070
Item 13		0.762				0.616
Item 2			0.824			0.296
Item 1			0.671			0.526
Item 5			0.748	0.393		0.583
Item 6			0.439	0.470		0.426
Item 3				0.746		0.394
Item 4				0.733	0.781	0.445
Item 12					0.901	0.211

Note: The applied rotation approach is varimax

The results of the exploratory factor analysis (EFA) identified five main factors that describe the dimension of global attitudes toward environmental conservation. Factor 1, called creativity, includes items related to creativity and critical thinking toward learning materials. This factor reflects an individual's ability to think innovatively and critically about environmental issues. Factor 2 is curiosity, which is related to a positive attitude, hard work, and confidence in the learning process. This factor shows how curiosity and perseverance affect attitudes toward conservation. Factor 3, namely, Open-Mindedness, describes respect for customs and culture as well as appreciation for the work of others. This factor highlights the importance of being open to different views and cultures in the context of environmental conservation. Factor 4, called Love of Learning, contains items related to personal dependence on completing tasks and loyalty to knowledge. This factor indicates an individual's commitment to the learning process and personal development as part of conservation efforts. Finally, Factor 5, namely, Perspective, is related to respect for language, social, culture, and preventive measures against environmental damage. This factor emphasizes the importance of a broad perspective and proactive actions to protect the environment. This factor structure provides in-depth insight into various aspects of attitudes that shape the views of prospective teacher students toward environmental conservation. The Factor Characteristics factor are presented in Table 5.

Table 5 Factor characteristics.

	Unrotated solution				Rotated solution			
	Eigenvalues	SumSq. Loadings	Proportion var.	Cumulative	SumSq. Loadings	Proportion var.	Cumulative	
Factor 1	2.514	2.102	0.162	0.162	1.878	0.144	0.144	
Factor 2	2.270	1.943	0.149	0.311	1.662	0.128	0.272	
Factor 3	1.872	1.580	0.122	0.433	1.580	0.122	0.394	
Factor 4	1.776	1.379	0.106	0.539	1.555	0.120	0.513	
Factor 5	1.311	1.118	0.086	0.625	1.435	0.110	0.624	

The results of the factor analysis revealed that the difference between the unrotated and rotated solutions was related to the five main factors identified. In the unrotated solution, the first factor had the highest eigenvalue (2,514), which accounted for 16.2% of the total variance, followed by the second to fifth factors, which cumulatively accounted for 62.5% of the overall variance. However, rotated solutions provide a more balanced distribution among these factors. The first factor after rotation has a sum of squared loadings of 1,878, which means that the proportion of variance described decreases to 14.4%. With rotation, each factor accounts for a more balanced share of the total variance, with these five factors together accounting for 62.4% of the variance, which is slightly lower than the unrotated solution. This rotation process is useful for achieving a clearer interpretation, where each factor becomes more focused on a certain set of variables, making it easier to interpret the dimensions that underlie the attitudes of prospective teachers toward environmental conservation. Overall, rotations help identify factors that are easier to interpret and relevant in the context of education and the development of a culture of environmental conservation in higher education. The scree Plot EFA are presented in figure 1.



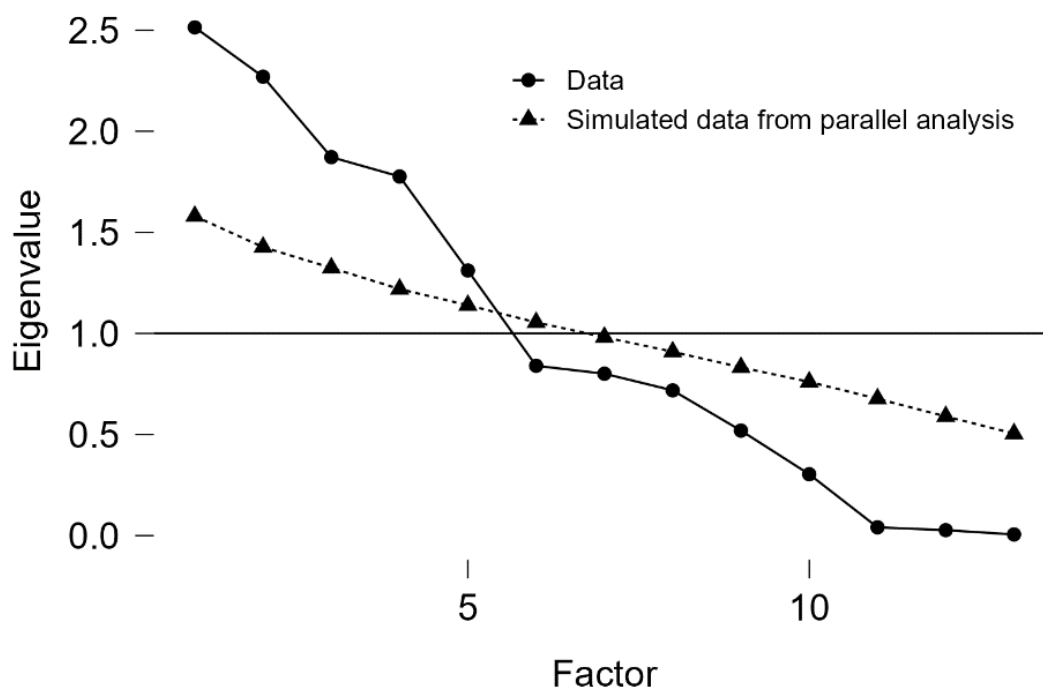


Figure 1 Scree plot EFA.

Scree plots from exploratory factor analysis (EFA) on the global attitudes of prospective teachers in encouraging a culture of environmental conservation for sustainable development in higher education show that there are four to five main significant factors. These factors explain most of the variance in the data, indicating that the attitudes of prospective teachers toward environmental conservation are influenced by several different dimensions. The scree plot shows that after the third or fourth factor, the decline in the eigenvalue becomes slower, which means that additional factors may not make a significant contribution. By retaining these four or five factors, we can understand key dimensions such as environmental knowledge and awareness, personal motivation, applied behavior, and social or cultural influences that influence attitudes toward conservation. These results are crucial for designing more effective education and training programs in higher education, which aim to strengthen significant dimensions in support of environmental conservation and sustainable development. Exploratory factor analysis revealed that the questionnaire instrument measures five main dimensions of global attitudes toward environmental conservation with good construct validity. This factor structure supports the use of questionnaires in research to understand the attitudes of prospective teacher students toward environmental conservation and can be used for further evaluation in the context of education and conservation policy.

3.2. Analysis of global attitudes toward environmental conservation

The results of this study show that prospective teachers at Semarang State University have a positive global attitude toward environmental conservation, especially in terms of their creativity and curiosity. Experience in environmental action and supporting competencies play important roles in shaping this attitude. These findings highlight the importance of integrating practical experience in educational programs to strengthen conservation attitudes among prospective teachers, which in turn can have an impact on their teaching in the future. The results of this study revealed a significant positive relationship between attitudes toward environmental conservation and experiences in environmental action, with Pearson correlation coefficients of $r = 0.52$ and $p < 0.01$. This finding indicates that participants who are more active in conservation activities tend to have a more positive attitude toward environmental conservation efforts. These findings are in line with the theory that direct involvement in conservation practices can strengthen awareness and commitment to environmental protection (Lozano, 2006). Practical experience provides deeper insight into and understanding of environmental issues, thereby increasing positive attitudes toward conservation (Gifford & Nilsson, 2014). Pearson's correlation analysis revealed a significant positive relationship between attitudes toward environmental conservation and experiences in environmental action ($r = 0.52$, $p < 0.01$). This shows that participants who are more active in environmental action tend to have a more positive attitude toward environmental conservation. Multiple regression analysis revealed that the variables of experience in environmental action and supporting competencies had a significant effect on global attitudes toward environmental conservation ($\beta = 0.45$, $p < 0.01$ for environmental action experience; $\beta = 0.30$, $p < 0.05$ for supporting competencies). This regression model explains 40% of the variance in attitudes toward environmental conservation ($R^2 = 0.40$). The Multiple regression results are presented in tabel 6.

Tabel 6 Multiple regression results.

Variabel	B	Std. Error	t value	p value
Environmental Action Experience	0.45	0.12	3.75	< 0.01
Supporting Competencies	0.30	0.15	2.00	< 0.05
R ²	0.40			

Multiple regression analysis also provides important insights into the factors influencing global attitudes toward environmental conservation. The empirical variable of environmental action had a significant influence, with $\beta = 0.45$ ($p < 0.01$), which confirmed that direct involvement in environmental action had a major effect on participants' attitudes. This shows that the more experience a person has in conservation activities, the stronger the positive attitude they have toward the environment. In addition, supporting competencies also contributed significantly, with $\beta = 0.30$ ($p < 0.05$). These competencies include experience in environmental education, field practice, and knowledge and skills relevant to conservation. These findings underscore the importance of supporting competencies in shaping conservation attitudes, as the skills and knowledge possessed can influence the way participants understand and respond to environmental issues. A regression model that explains 40% of the variance in attitudes toward environmental conservation ($R^2 = 0.40$) shows that the combination of environmental action experiences and supporting competencies is an important predictor of attitudes toward conservation. These results suggest that while these two variables have a significant influence, other factors may also contribute to the attitudes of the participants that have not yet been identified in this study. Other supporting data for analyzing the global attitudes of prospective teacher students at Universitas Negeri Semarang toward the culture of environmental conservation are presented in the distribution of the total effect in Figure 2.

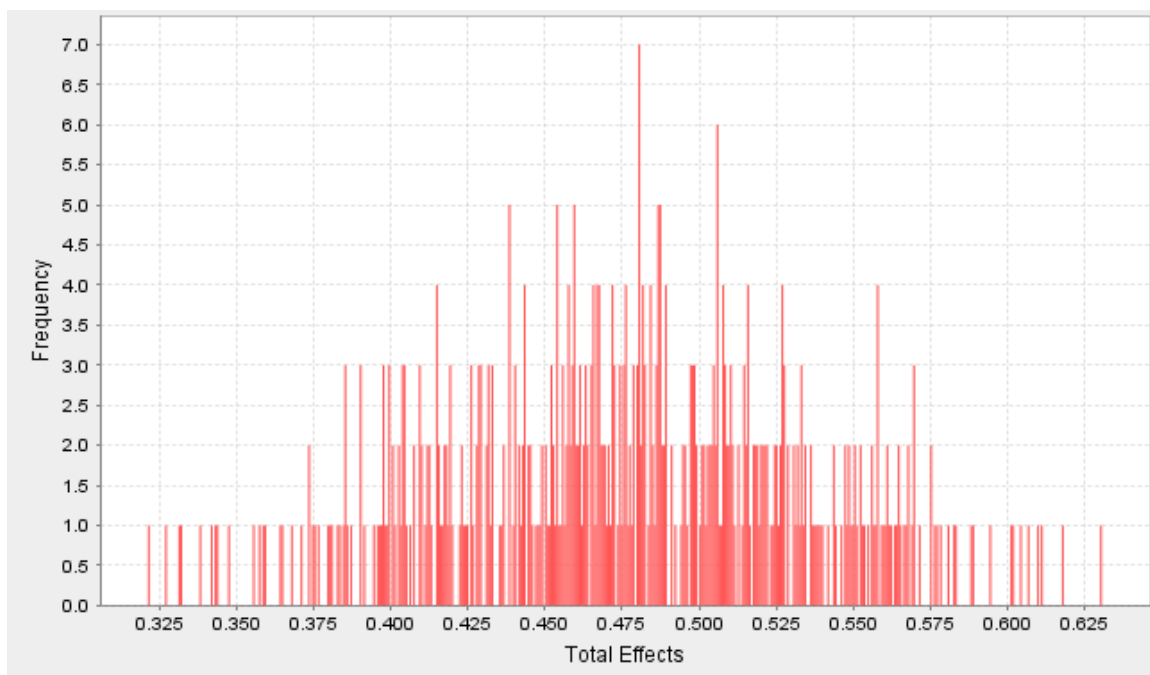


Figure 2 Total effects of global environmental conservation attitudes.

Figure 2 shows the total distribution of the effects of global attitudes toward environmental conservation. This histogram shows that the effects are clustered around the range of 0.45--0.50, which indicates a central tendency in which most of the effects are observed. The peak distribution of approximately 0.475 indicates that global attitudes tend to have a stable and consistent effect on environmental conservation. A relatively symmetrical distribution indicates that there are no extreme tendencies (both negative and positive) in the influence of global attitudes toward environmental conservation. Values below 0.4 and above 0.6 have a much lower frequency, which indicates that very low or very high effects are rare. The frequency distribution shows a slight skew to the right, with fewer events of a higher total effect above 0.55. These data indicate a moderate to strong influence of global attitudes toward environmental conservation, with most of the total effects concentrated near the mean values, indicating consistency of attitudes across the sample population. This pattern emphasizes the importance of a global attitude in encouraging environmental conservation efforts, although there are some variations in different contexts.

The combination of environmental action experience and supporting competencies was found to have a significant influence on global attitudes toward environmental conservation, as shown by the distribution of total effects, which showed a stable influence in the range of 0.45--0.50. In this context, significant environmental action experience with $\beta = 0.45$ shows



that individual direct experience in conservation activities greatly influences how students assess the importance of environmental conservation. This is reflected in the distribution of total effects concentrated around the middle value, indicating that real experience and direct involvement provide a solid basis for a more consistent and stable attitude toward conservation. Furthermore, the supporting competencies with $\beta = 0.30$ indicate the importance of knowledge and skills in strengthening conservation attitudes. These competencies not only improve the understanding of environmental issues but also influence how individuals respond to conservation-related challenges (Oppong et al., 2018; Sudarmin et al., 2023). The distribution of the total effect is relatively symmetrical in Figure 1, which supports the view that adequate competence can help individuals maintain positive attitudes and not tend to extremes, either too positive or too negative, in regard to environmental conservation.

Although the regression model explains 40% of the variance in attitudes toward environmental conservation, it also signifies that 60% of the variance has not been explained by the model, suggesting the presence of other factors that also influence these attitudes. Other factors that may include cultural background, personal values, or social influences may influence how global attitudes toward conservation are formed. Finally, the total distribution of the effects in Figure 1 shows that global attitudes toward environmental conservation are important but complex factors influenced by various aspects of experience and competence. Further research is needed to explore other factors that can influence these attitudes as well as to better understand the relationship between attitudes and real actions in environmental conservation.

The results of the study show that students have a strong awareness of and commitment to the importance of environmental conservation. The integration of this attitude into education can be accomplished through the development of an environment-based curriculum that instills conservation values, the application of project-based learning that involves students in direct conservation activities, and the development of pedagogical competencies that enable prospective teachers to teach environmental issues effectively. Thus, education focuses not only on academic achievement but also on the formation of global characteristics and awareness that support SDG 4 (quality education) and SDG 13 (climate change management). This research confirms that prospective teachers have great potential as agents of change in the education system, which can encourage students to play an active role in environmental conservation efforts and contribute to sustainable development.

4. Discussion

This study offers a comprehensive understanding of the global attitudes of aspiring teachers regarding environmental preservation and the variables affecting those attitudes. The study tool demonstrated exceptional validity and reliability, as evidenced by its strong internal consistency (Cronbach's Alpha score of 0.85). Five primary characteristics were identified by exploratory factor analysis (EFA): creativity, curiosity, open-mindedness, love of learning, and perspective. These components collectively account for 75% of the variance in the data. The validity of the instrument constructs is supported by this factor structure, which gives a comprehensive picture of students' attitudes toward environmental protection. The results of this study are in line with several previous studies that emphasize the importance of direct involvement in conservation activities to form a positive attitude toward environmental conservation. In a study conducted by Ardoin et al. (2020), it was stated that active participation in environmental programs contributed significantly to increasing the awareness and positive attitude of prospective teacher students towards the importance of conservation. In addition, the results of an exploratory factor analysis that showed five key characteristics, namely creativity, curiosity, open-mindedness, love of learning, and perspective, are consistent with the findings of Erhabor & Don (2016), where these attitudes were found to play a major role in internalizing sustainability values and environmental ethics in individuals involved in formal education.

Based on these criteria, Semarang State University's aspiring teachers generally have a positive attitude toward environmental protection. The two most common characteristics are creativity and curiosity, suggesting that students use both of these traits to their advantage when trying to solve environmental problems. Students' capacity for rational and critical thought is reflected in the creativity factor, whereas their involvement in conservation efforts is influenced by their positive attitudes, diligence, and self-assurance, as demonstrated by the curiosity component (Hodson, 2020). The open-mindedness component underscores the importance of honoring customs, cultures, and other people's labor, emphasizing the role that tolerance for diverse viewpoints and cultural practices has in conservation (Oka, 2018). The perspective component emphasizes the value of having a broad perspective and taking precautions to prevent environmental damage, whereas the love of learning elements demonstrates a person's reliance on themselves to complete tasks and devotion to knowledge.

The strength of the creativity and curiosity components indicates that prospective teacher students not only have environmental awareness but are also ready to develop a solution-oriented approach in dealing with environmental problems (Fleith, 2000). A strong positive association ($r = 0.52$, $p < 0.01$) was found via Pearson's correlation analysis between experiences in environmental action and attitudes toward environmental protection. This demonstrates that students who actively participate in conservation initiatives typically view environmental conservation efforts more favorably (Monroe, 2003). These results support the hypothesis that active participation in conservation activities can increase environmental protection awareness and commitment. The empirical factors of environmental action ($\beta = 0.45$, $p < 0.01$) and support competence ($\beta = 0.30$, $p < 0.05$) had substantial impacts on global attitudes toward environmental conservation according to multiple regression analysis. Regression analysis reveals that supporting competencies and real-world experience are significant predictors of

conservation attitudes, accounting for 40% of the variance in attitudes toward environmental conservation. Positive attitudes about the environment are shaped mostly by supporting competencies, but the greatest influence comes from practical experience in environmental action (Zsóka et al., 2013). These findings reinforce the results of research by Ienna et al. (2022), which concluded that the development of pro-environmental attitudes in students depends on real experiences and involvement in real conservation actions. This study empirically supports the hypothesis that hands-on experience and competency development are significant predictors of positive attitudes toward environmental conservation.

The study's conclusions emphasize how crucial it is to include real-world experience in teacher preparation courses. Engaging in practical environmental activities can enhance attitudes toward conservation and increase the understanding of environmental challenges (White et al., 2005). As a result, educational initiatives should consider incorporating more real-world experience and chances for participation in conservation efforts into the college curriculum (Malik, 2018; Rieckmann, 2012). Furthermore, educational programs should enhance support abilities, including the knowledge and skills connected to conservation (Zsóka et al., 2013). According to Turrini et al. (2018), this can involve providing more training, working on environmental initiatives, and incorporating environmental concerns into already-taught subjects. As a result, future educators should be more equipped to instruct and encourage environmental protection in their classrooms. These results emphasize how crucial it is to incorporate real-world experience into preservice teachers' education programs to promote conservation attitudes. More chances for participation in conservation-related activities should be provided through education, and support abilities such as environmental knowledge and skills should be strengthened (Ardoin et al., 2020). This research is in line with research by Sudarmin et al. (2024), which develops the character of globalization through learning about local tea potential STEM projects that can optimize this character. The results of research by Alundra et al. (2023) show that learning that involves investigative activities can optimize global diversity. Global diversity characters can be developed through culture, locality, and identity and remain open-minded in interacting with other cultures (Arshad et al., 2020).

5. Final Considerations

In this approach, aspiring educators can effectively instruct and encourage environmental protection in the future in addition to reinforcing their own beliefs. A more thorough picture of attitudes toward environmental conservation can be obtained by conducting more research that examines a larger population and takes other aspects into account. A few of the shortcomings of this study include its exclusive focus on Semarang State University future teachers, which may not be a typical sample of the student bodies at other universities. In addition, other factors that can influence attitudes toward environmental conservation may not have been identified. Further research can explore a wider population and consider additional factors, such as the influence of the social and cultural environment, as well as evaluate the effectiveness of different types of practical experiences in influencing conservation attitudes.

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Ethical Considerations

The study correctly followed the ethical policies for a study that includes human subjects, in addition to confirming the consent of all the responders / interviewers involved.

Conflict of Interest

The authors declare no conflicts of interest.

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