



## Sustainability consciousness level among pre-service biology teacher student

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### ABSTRACT

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, aim to address global challenges such as poverty, inequality, and climate change. Achieving these goals requires sustainability consciousness, which encompasses awareness, knowledge, attitudes, and behaviour toward sustainable development. This study evaluates the sustainability consciousness of pre-service Biology Education teacher students at Universitas Negeri Padang using the Sustainability Consciousness Questionnaire (SCQ). The SCQ, adapted from Gericke et al. (2018), consists of 50 statements covering economic, social, and environmental dimensions, and assesses sustainability knowingness, attitudes, and behavior using a 4-point Likert scale. Data analysis employed descriptive statistics to categorize respondents into low, medium, and high levels of sustainability consciousness. The results reveal that 88.5% of students demonstrate medium sustainability consciousness, 7.7% exhibit low consciousness, and 3.8% display high consciousness. The study also found that sustainability consciousness was highest in the social dimension, with strong attitudes and behaviors related to social sustainability, while the environmental and economic dimensions showed more variability. These findings underscore the need for targeted educational interventions to enhance sustainability consciousness among pre-service teachers, which is essential for integrating sustainability into higher education curricula.



## INTRODUCTION

Sustainable Development Goals (SDGs) are a set of 17 global goals established by the United Nations in 2015 to address various challenges facing humanity, including poverty, inequality, climate change, environmental degradation, peace, and justice (Herrero et al., 2021). These goals are interconnected and aim to promote sustainable development by balancing economic growth, social inclusion, and environmental protection (Fonseca et al., 2020). The SDGs provide a framework for countries, businesses, and organizations to work towards a more sustainable future for all (Erin et al., 2022). SDGs are a crucial framework for global development, with education playing a central role in achieving these goals. Higher education institutions are increasingly focusing on aligning their efforts with the SDGs (Chankseliani & McCowan, 2021).

SDGs can indeed be achieved when individuals possess sustainability consciousness. This consciousness involves individual's awareness, knowledge, attitudes, and behaviors towards sustainable development encompassing environmental, social, and economic dimensions (Gericke et al., 2019; Zhao et al., 2020; Nousheen & Kalsoom, 2022). The United Nations has emphasized the integration of sustainable development actions into education to foster changes in knowledge and attitudes towards sustainability, highlighting the importance of education in promoting sustainability consciousness (Baena-Morales et al., 2021; Hüttel & Balderjahn, 2022).

Education for Sustainable Development (ESD) is highlighted as a key aspect of the SDGs, emphasizing the importance of quality education in the global agenda. ESD is a crucial approach aimed at equipping individuals with the knowledge, skills, and values necessary to address sustainability challenges (Sinakou et al., 2019). The United Nations has emphasized the importance of education in the context of sustainability through initiatives like the Decade of Education for Sustainable Development (Quelhas et al., 2019). ESD aims to cultivate competencies in students that empower them to engage in sustainable practices and decision-making (Demssie et al., 2020). Higher education institutions play a pivotal role in promoting sustainable development by empowering individuals to embrace sustainable principles and work towards a sustainable future (Fahim et al., 2021). Educational organizations are pivotal in driving education for sustainable development, with a focus on curriculum development and transformational leadership (Hidayati et al., 2021). Education and sustainable development are intertwined, promoting the knowledge, skills, values, and measures essential for creating a sustainable world and ensuring environmental protection, social justice, and economic sustainability (Krayneva et al., 2021).

Recent research has increasingly focused on university student sustainability consciousness as a vital area of study. Multiple studies, such as those by (Korsager & Scheie, 2019) and (Marcos-Merino et al., 2020), have examined the sustainability awareness, attitudes, and behaviors of university students towards sustainable development. The implementation of the Sustainability Consciousness Questionnaire (SCQ) can foster sustainability-conscious students, accelerating the incorporation of sustainability into higher education curricula (Zhao et al., 2020). This study analyzes the sustainability consciousness of pre-service Biology Education students at Universitas Negeri Padang. While most students showed moderate consciousness, particularly in the social dimension, sustainable behaviors especially in environmental and economic aspects were relatively low. This highlights the need for integrating Education for Sustainable Development (ESD) into teacher training and points to a research gap in evaluating long-term impacts of ESD and effective pedagogical strategies to promote sustainable behavior.

## METHODS

Descriptive analysis is an analysis that aims to describe the data from the variables obtained. Data was collected through distributing questionnaires formed in a measurement scale. The instrument used to assess pre-service teacher students' sustainability consciousness in this study was the

Sustainability Consciousness Questionnaire (SCQ) adapted from (Gericke et al., 2019), this questionnaire includes 50 statements covering the three pillars of Sustainable Development Goals (SDGs): economic, social, and environmental. It evaluates three competencies: sustainability knowingness, sustainability attitude, and sustainability behavior. Responses are rated on a 4-point Likert scale, ranging from "strongly agree" to "strongly disagree".

The statistical method used to find out the amount of hypothetical mean (Theoretical Mean) and Standard Deviation ( $\sigma$ ) based on the number of items and the maximum score and minimum score on each alternative answer. The categories used in this study use categorization based on the normal distribution model. The calculated scores are the minimum score, maximum score, mean, and standard deviation of each variable. Hypothetical scores are generated from manual calculations. The formula for finding the hypothetical score is as follows.

- a. Minimum score: lowest item score X total number of items
- b. Maximum Score: highest item score X total number of items
- c. Hypothetical mean: total number of items X mid value of item scored.
- d. Standard Deviation:  $\frac{\text{maximum score} - \text{minimum score}}{6}$

After obtaining the results of the hypothetical score, a description of the variables studied will be obtained, then descriptive analysis is carried out on each measuring instrument used. This descriptive analysis is needed to classify respondents into three categories, namely low, medium, and high by finding the hypothetical standard deviation and hypothetical mean. The norms used refer to the norms which are as follows:

**Table 1.** Category norms and decision area

| Category | Decision area                    |
|----------|----------------------------------|
| Low      | $X < (\mu - SD)$                 |
| Medium   | $(\mu - SD) \leq X < (\mu + SD)$ |
| High     | $(\mu + SD) \leq X$              |

## RESULTS AND DISCUSSION

The analysis of sustainability consciousness among pre-service teacher students reveals a significant distribution across different levels of consciousness. As shown in Table 2, the majority of students (88.5%) fall into the medium category of sustainability consciousness, indicating a moderate level of awareness and understanding of sustainability issues. A smaller proportion of students (7.7%) exhibit low sustainability consciousness, while only a minimal fraction (3.8%) are categorized as having high sustainability consciousness. This distribution highlights the need for targeted educational interventions to enhance sustainability consciousness among pre-service teachers.

**Table 2.** Sustainability consciousness level among pre-service teacher students (%)

| Category | Frequency | Percentage |
|----------|-----------|------------|
| Low      | 6         | 7,7 %      |
| Medium   | 69        | 88,5 %     |
| High     | 3         | 3,8 %      |

The predominance of medium-level sustainability consciousness suggests that while students possess a basic understanding of sustainability concepts, there is ample room for improvement in fostering higher levels of consciousness. This finding aligns with previous studies that emphasize the importance of pedagogical approaches in developing sustainability consciousness among pre-service teachers (Marcos-Merino et al., 2020; Nousheen & Kalsoom, 2022; Botes, 2021). Moreover, the low percentage of students with high sustainability consciousness underscores the necessity of integrating comprehensive sustainability education within teacher training programs (Gopalakrishnan et al., 2019). This approach is critical for preparing future educators to effectively incorporate sustainable development principles in their teaching practices.

The findings of this study reveal critical insights into the sustainability consciousness of pre-service teacher students, which holds substantial implications for the integration of sustainable development principles in education. The predominance of middle-level sustainability consciousness, as illustrated in Table 1, indicates that while there is a foundational awareness of sustainability, there is significant potential for improvement. This aligns with the emphasis on the importance of pedagogical approaches in developing sustainability consciousness, as noted by (Nousheen & Kalsoom, 2022). Enhancing these pedagogical methods, particularly through online education platforms, could significantly boost students' sustainability awareness, especially in light of the adaptations required during the COVID-19 pandemic.

The low percentage of students exhibiting high sustainability consciousness underscores the need for targeted educational strategies and resources. The challenges identified by (Khadim et al., 2023) in implementing education for sustainable development such as lack of commitment from students, inadequate support, and limited instructional resources must be addressed to elevate sustainability consciousness to higher levels. By integrating more robust sustainability education within teacher training programs, educators can better prepare pre-service teachers to incorporate sustainable practices in their future classrooms, ultimately fostering a generation of students who are more environmentally conscious and proactive.

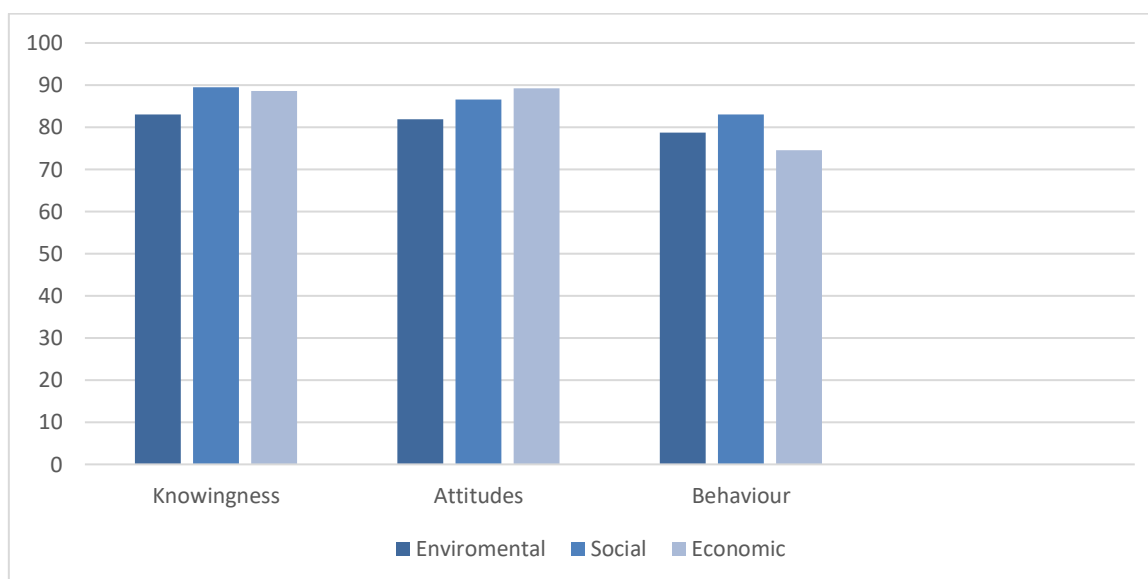
Furthermore, the development of scales to measure environmental consciousness, as emphasized by (Zeeshan & Qureshi, 2023), is vital for tailoring educational interventions. Understanding the specific levels of sustainability consciousness among pre-service teachers allows for the creation of targeted programs that address the gaps in knowledge and awareness. (Duran & Bozok, 2021) advocate for the integration of sustainable development education in early childhood, which can cultivate long-term environmental awareness from a young age. Implementing these insights in teacher education programs ensures that pre-service teachers are not only knowledgeable but also equipped to foster sustainability consciousness in their students, thereby amplifying the impact of sustainable development education across generations.

The relationship between proactivity, personal pedagogical knowledge, and sustainability consciousness, as discussed by (Gopalakrishnan et al., 2019), highlights the need for dynamic and engaging educational practices. Incorporating social media and other digital platforms into sustainability education can enhance proactivity and engagement among pre-service teachers. Additionally, fostering professional identity development and socio-political consciousness, as noted by (Freire, 2021) and (Prawiro, 2021) is crucial in preparing educators who are committed to social justice and sustainability. This comprehensive approach to teacher education, integrating both pedagogical knowledge and practical skills, is essential for cultivating a deeply ingrained sustainability consciousness that can be effectively passed on to future generations.

The results presented in Figure 1 indicate a high level of sustainability consciousness among pre-service teacher students, particularly in the social dimension, which scored the highest across all categories (knowingness: 89.5%, attitudes: 89.2%, behavior: 83%). These findings are consistent with previous research highlighting the importance of social sustainability education. For instance, (Marcos-Merino et al., 2020) found similar trends among pre-service teachers in Spain, where social aspects of sustainability were emphasized in their educational programs. This alignment

underscores the effectiveness of current curricula in fostering social sustainability awareness among future educators.

Comparatively, the environmental and economic dimensions showed slightly lower percentages, with knowingsness scores of 83% and 88.6% respectively, and behavior scores of 83% and 74.5% respectively. This suggests a potential area for enhancement, as highlighted by (Msengi et al., 2019), who emphasized the necessity of a comprehensive approach to sustainability education that equally addresses all dimensions. The lower economic sustainability scores may indicate a gap in integrating economic sustainability concepts within educational frameworks, an issue also noted by (Saleh et al., 2022) who stressed the importance of economic understanding in driving sustainable behavior.



**Figure 1.** Percentage of sustainability consciousness among pre-service teacher students (%)

Furthermore, the study by (Korsager & Scheie, 2019) supports the notion of a dominant mono-dimensional approach to sustainability education. The relatively balanced scores across the environmental and social dimensions in our study contrast with their findings, suggesting that while progress has been made, there is still a need to enhance the focus on the economic dimension to provide a more holistic sustainability education. The findings presented in Figure 1 are significant as they provide insights into the current state of sustainability consciousness among pre-service teacher students. The high scores in social sustainability indicate that these future educators are well-prepared to promote social justice and community well-being, aligning with the pedagogical principles advocated by (Maini, 2022). This preparation is crucial as teachers play a vital role in shaping the sustainability consciousness of future generations.

The relatively lower scores in the economic dimension highlight an area for potential improvement. Enhancing economic sustainability education could foster a more comprehensive understanding of sustainability among students, thereby preparing them to address complex global challenges. As suggested by (Agu et al., 2021), integrating economic sustainability into educational curricula is essential for equipping students with the skills needed to support Sustainable Development Goals (SDGs). The findings underscore the crucial role of universities in fostering sustainability consciousness through continuous and systemic educational approaches (Savelyeva & Douglas, 2017). The significant variation in sustainability behaviors suggests that while knowledge and attitudes are relatively well-developed, translating these into consistent sustainable actions remains challenging. (Agu et al., 2021) emphasized the importance of sustainability-oriented education in promoting sustainable consumption, which is evident from the lower behavioral scores observed.

Additionally, integrating sustainability education into higher education curricula is essential for equipping students with the necessary knowledge and skills to address global sustainability challenges (Agu et al., 2021). The data also align with (Zhao et al., 2020), who highlighted the impact of curricular emphasis and instructional practices on students' sustainability consciousness. By fostering a culture of sustainability consciousness, universities can prepare students to contribute effectively to sustainable development both within and beyond the campus environment (Jónsdóttir, 2021).

The results of this study, presented in Table 3, highlight the levels of sustainability consciousness among pre-service teacher students, categorized into three main variables: Sustainability Knowingness (SK), Sustainability Attitudes (SA), and Sustainability Behaviour (SB). Within the Sustainability Knowingness variable, the environmental dimension shows significant variability, with item SK1 recording the lowest mean score of 60.6 and a high standard deviation of 24.7. This suggests a wide range of environmental knowledge among the students. Conversely, items such as SK4, SK10, and SK12 display high mean scores (91.0, 91.0, and 91.7, respectively) and lower standard deviations, indicating a more uniform understanding of specific environmental aspects.

**Table 3.** Sustainability consciousness among pre-service teacher students (%)

| Variable                        | Dimension     | Item code | Mean score | Std deviation |
|---------------------------------|---------------|-----------|------------|---------------|
| Sustainability Knowingness (SK) | Environmental | SK1       | 60,6       | 24,7          |
|                                 |               | SK2       | 87,2       | 22,0          |
|                                 |               | SK3       | 87,5       | 16,5          |
|                                 |               | SK4       | 91,0       | 14,5          |
|                                 |               | SK5       | 85,6       | 16,4          |
|                                 |               | SK6       | 86,2       | 16,4          |
|                                 | Social        | SK7       | 88,5       | 14,9          |
|                                 |               | SK8       | 87,8       | 14,4          |
|                                 |               | SK9       | 87,8       | 14,4          |
|                                 |               | SK10      | 91,0       | 13,9          |
|                                 |               | SK11      | 91,7       | 13,8          |
|                                 |               | SK12      | 91,7       | 13,8          |
|                                 |               | SK13      | 87,8       | 14,9          |
|                                 | Economic      | SK14      | 89,7       | 13,6          |
|                                 |               | SK15      | 91,3       | 12,6          |
|                                 |               | SK16      | 88,5       | 13,2          |
|                                 |               | SK17      | 87,2       | 15,5          |

| Variable                      | Dimension    | Item code | Mean score | Std deviation |
|-------------------------------|--------------|-----------|------------|---------------|
| Sustainability Attitudes (SA) | Enviromental | SK18      | 88,5       | 16,0          |
|                               |              | SK19      | 87,5       | 14,4          |
|                               |              | SA1       | 73,1       | 26,7          |
|                               |              | SA2       | 90,1       | 15,8          |
|                               |              | SA3       | 86,9       | 16,0          |
|                               |              | SA4       | 77,6       | 25,0          |
|                               | Social       | SA5       | 91,0       | 13,3          |
|                               |              | SA6       | 86,9       | 18,3          |
|                               |              | SA7       | 77,9       | 19,3          |
|                               |              | SA8       | 82,7       | 17,7          |
|                               | Economic     | SA9       | 88,1       | 13,8          |
|                               |              | SA10      | 92,9       | 12,7          |
|                               |              | SA11      | 89,7       | 14,2          |
|                               |              | SA12      | 93,3       | 11,9          |
| Sustainability Behaviour (SB) | Enviromental | SA13      | 83,0       | 16,4          |
|                               |              | SA14      | 90,7       | 13,4          |
|                               |              | SB1       | 80,8       | 18,4          |
|                               |              | SB2       | 83,0       | 15,9          |
|                               |              | SB3       | 73,4       | 19,0          |
|                               |              | SB4       | 82,4       | 15,7          |
|                               | Social       | SB5       | 78,2       | 25,6          |
|                               |              | SB6       | 72,1       | 20,1          |
|                               |              | SB7       | 80,8       | 19,3          |
|                               |              | SB8       | 87,5       | 14,4          |
|                               |              | SB9       | 68,3       | 26,9          |
|                               |              | SB10      | 67,9       | 27,3          |
|                               |              | SB11      | 91,7       | 13,2          |

| Variable | Dimension | Item code | Mean score | Std deviation |
|----------|-----------|-----------|------------|---------------|
|          |           | SB12      | 91,0       | 13,3          |
|          |           | SB13      | 91,3       | 13,9          |
|          | Economic  | SB14      | 84,6       | 15,2          |
|          |           | SB15      | 58,3       | 24,7          |
|          |           | SB16      | 79,2       | 19,9          |
|          |           | SB17      | 76,0       | 17,3          |

The social dimension under Sustainability Knowingness also exhibits strong scores, with items SK6 and SK11 achieving mean scores of 86.2 and 91.7, respectively. This indicates a solid grasp of social sustainability principles. Similarly, in the economic dimension, items SK14 and SK16 reflect high mean scores (89.7 and 88.5, respectively) with low standard deviations, demonstrating consistent knowledge in economic sustainability among the students. Regarding Sustainability Attitudes, the environmental dimension shows that items SA1 and SA2 have high mean scores of 90.7 and 90.1, respectively, with relatively low standard deviations, suggesting positive attitudes towards environmental sustainability. The social dimension also records high scores, with SA4 and SA5 showing mean scores of 91.0 and 86.9, respectively, indicating favourable social sustainability attitudes. In the economic dimension, item SA12 stands out with a high mean score of 93.3 and a low standard deviation, reflecting strong economic sustainability attitudes. Finally, the Sustainability Behaviour variable reveals varied levels of engagement in sustainable practices. The environmental dimension, represented by item SB1, shows a mean score of 80.8, while items SB3 and SB9 display lower mean scores of 73.4 and 68.3, respectively, indicating a need for improvement in certain sustainable behaviors. The social dimension highlights high scores for items SB11 and SB13 (91.7 and 91.3, respectively), suggesting strong social sustainability behaviors. In the economic dimension, item SB14 has a notable mean score of 84.6, pointing to significant economic sustainability behaviors among the students.

The findings in Table 3 reveal significant insights into the sustainability consciousness among pre-service teacher students, aligning with various dimensions highlighted in existing literature. (Zeeshan & Qureshi, 2023) highlight the importance of measuring environmental consciousness among pre-service teachers, which aligns with the high mean scores observed for environmental sustainability items such as SK4 (91.0) and SK10 (91.0). These high scores suggest that pre-service teachers are well-equipped with the necessary knowledge to effectively teach about sustainability in their classrooms, a crucial aspect for fostering sustainability awareness in future generations. Moreover, the study by (Nousheen & Kalsoom, 2022) on the impact of sustainability pedagogies is particularly relevant here. The high scores in the social and economic dimensions of Sustainability Knowingness (e.g., SK11 at 91.7 and SK14 at 89.7) indicate that innovative pedagogical approaches in teacher education are effectively enhancing pre-service teachers' sustainability consciousness. This suggests that incorporating sustainability pedagogies into teacher training programs can significantly improve the preparedness of future educators to integrate sustainability principles into their teaching practices.

(Khadim et al., 2023) discusses the challenges faced by teacher educators in integrating sustainability knowledge, emphasizing the need for institutional support. The variability in the environmental dimension, particularly the high standard deviation for SK1 (24.7), indicates that some students may not have uniform access to resources or support, highlighting the need for more consistent and supportive educational frameworks. Addressing these challenges is essential

to ensure that all pre-service teachers develop a robust understanding of sustainability. Further, (Gülçiçek, 2021; Marcos-Merino et al., 2020) highlight the relationship between self-efficacy beliefs and sustainability attitudes, as well as gender differences in sustainability consciousness. The high mean scores in items such as SA2 (90.1) and SB11 (91.7) suggest strong self-efficacy and positive attitudes toward sustainability among pre-service teachers. However, the gender differences noted by (Marcos-Merino et al., 2020) indicate that there may be disparities in sustainability consciousness that need to be addressed to ensure all pre-service teachers, regardless of gender, are equally prepared to promote sustainability.

Awareness of sustainable development goals (SDGs) among pre-service teachers, emphasizing the importance of integrating these goals into the curriculum. The high mean scores in the economic dimension of Sustainability Attitudes (e.g., SA12 at 93.3) reflect a strong awareness and positive attitudes towards the SDGs. This suggests that pre-service teachers are not only knowledgeable about sustainability but are also motivated to incorporate these goals into their future teaching.

## CONCLUSION

The analysis of sustainability consciousness among pre-service teacher students reveals that 88.5% exhibit moderate consciousness, 7.7% show low consciousness, and 3.8% are highly conscious. These findings highlight the need for targeted educational interventions. The social dimension scored highest, with knowingness at 89.5%, attitudes at 89.2%, and behavior at 83%. The environmental and economic dimensions followed, with knowingness at 83% and 88.6%, respectively, and behavior at 83% and 74.5%, respectively. Significant positive attitudes towards environmental sustainability were noted, though behaviors, especially in the environmental dimension, need improvement. These insights are crucial for future educational programming and policy development.

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