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Assessing Sustainable Awareness of Madrasah Ibtidaiyah Students Within the Education for Supporting Sustainable Development Goals (SDGs) Framework

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ABSTRACT

This study aimed to analyze the level of sustainability awareness and commitment to the goals of education for sustainable development (ESD) among students in madrasah ibtidaiyah. A descriptive survey was conducted with 327 students in Sukabumi Regency using self-administered questionnaires that considered gender and grade level. Data were analyzed using descriptive statistics and one-way ANOVA. The results indicated that students demonstrated a moderate level of sustainability awareness, with an average score of 2.95. No significant differences were found across grade levels ($p = 0.158$), while female students showed significantly higher awareness than males ($p = 0.001$) in grades 3, 4, and 5. These findings suggest that gender is a more influential factor than grade level in shaping students' sustainability awareness. The results highlight the need for gender-responsive approaches in designing effective ESD programs in primary education.

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1. INTRODUCTION

The level of sustainability awareness among madrasah ibtidaiyah students in the context of Education for Sustainable Development (ESD) represents an important effort to address the global challenges of the 21st century. These challenges are strongly linked to the climate crisis, environmental pollution, and unsustainable consumption patterns, all of which demand critical awareness of sustainability issues. Such challenges cannot be solved through conventional approaches alone, but require the transformation of values, knowledge, and attitudes among global citizens. To respond to these complexities, UNESCO has placed ESD at the core of efforts to achieve the 2030 Sustainable Development Goals (SDGs), particularly Target 4.7, which emphasizes the importance of developing knowledge and skills to support sustainable development (Oe *et al*., 2022). In this regard, instilling values such as ecological awareness, social responsibility, and systemic thinking skills should begin at an early age, including at the elementary level in madrasah ibtidaiyah (Muflikhah, 2023).

ESD plays a crucial role in shaping students' attitudes and behaviors toward the environment from the early years of schooling. It is not merely a process of delivering information on sustainability issues but a holistic approach that integrates cognitive, affective, and conative dimensions to foster systemic thinking and responsible actions for the future of the planet and society (Batool, 2021). Effective ESD requires transformative pedagogical strategies that enable students to engage in reflective, participatory, and contextual learning. Strengthening ESD at the madrasah ibtidaiyah level is therefore strategic, as this stage marks the initial formation of students' character. Instilling values such as responsibility, social concern, and ecological awareness from an early age provides a strong foundation for nurturing a generation of empowered and visionary "sustainability citizens."

The success of ESD is realized not only through transformative learning processes but also through its main outcome, namely the development of sustainability awareness among students. Sustainability awareness serves as a key indicator of ESD implementation, as it reflects the extent to which students have internalized sustainability values holistically. At the basic education level, such as madrasah ibtidaiyah, this indicator is highly relevant to assess the effectiveness of ESD. Sustainability awareness encompasses three core dimensions: cognitive (understanding of issues such as climate change and social justice), affective (attitudes of care, empathy, and responsibility for a shared future), and conative (willingness and concrete actions to realize positive change). These dimensions not only serve as benchmarks for learning outcomes but also reflect the success of transformative education, which lies at the heart of the ESD approach. Consequently, fostering sustainability awareness at the madrasah ibtidaiyah level provides a strong foundation for nurturing a generation capable of critical thinking, ethical behavior, and proactive engagement for the sustainability of the planet.

Nevertheless, the implementation of ESD in madrasah ibtidaiyah faces several challenges, particularly due to the limited research and attention devoted to its integration in the madrasah context. While many studies and policies emphasize ESD implementation in public schools (Husin *et al*., 2025; Zulkarnaen *et al*., 2023; Lathifah *et al*., 2024; Ariza *et al*., 2021; Arantes & Sousa, 2025; Li *et al*., 2022a), madrasahs often escape in-depth analysis, despite their curriculum's significant potential to internalize sustainability values. The current madrasah ibtidaiyah curriculum tends to focus more heavily on the cognitive aspects of religion. However, there are opportunities to integrate ESD organically through the Islamic concept of rahmatan lil 'alamin, which emphasizes compassion for all creatures and the environment, and aligns with principles of social and ecological justice. For example, activities

such as energy saving and recycling encourage madrasah students to adopt sustainable behavior (Munawwaroh & Hariyani, 2024). Similarly, a case study at MI Khadijah Malang demonstrated how an environmental care culture was successfully established through the implementation of Adiwiyata programs (Puspita *et al*., 2024; Kurniati *et al*., 2025). These cases highlight the potential of madrasahs as strategic spaces for contextualizing ESD, grounding sustainability principles in inclusive and transformative religious narratives. Therefore, there is an urgent need for contextual research that explores the unique strengths of madrasahs in implementing ESD and contributes to the global discourse on diverse approaches to sustainable education (Tabrani *et al*., 2024).

Previous studies have also highlighted variations in sustainability awareness based on demographic factors such as gender and grade level, although findings remain inconsistent. Some research suggests that female students tend to show higher concern for environmental and social issues, while male students are more active in practical actions (Afifah & Daulae, 2025; Hafiza & Ferry, 2022; Rahmawati *et al*., 2023). However, these tendencies are not always consistent across educational contexts. Thus, further investigation is required to understand the influence of demographic variables, particularly gender and grade level, in the internalization of sustainability values in madrasah ibtidaiyah. Such an inquiry is crucial to ensure that ESD learning approaches are adaptive to students' characteristics and able to optimize each individual's potential in fostering meaningful sustainability awareness.

The uniqueness of this research lies in its empirical contribution to filling the contextual gap in the literature on ESD within the madrasah environment, which has thus far received limited scholarly attention. In addition, this study adapts validated instruments of sustainability awareness to the specific context of Islamic basic education, thereby offering insights into both theoretical development and practical applications.

2. METHODS

This study employed a quantitative design with a cross-sectional survey approach, which aims to objectively describe phenomena at a single point in time without intervention or manipulation of variables. This approach was chosen to capture a representative portrait of madrasah ibtidaiyah students' perceptions of sustainability awareness. The main focus was to measure the level of sustainability awareness and to analyze its variations based on demographic variables, namely gender and grade level.

The sample consisted of 327 madrasah ibtidaiyah students in Sukabumi Regency, selected using a simple random sampling technique. All participants were in grades III, IV, and V. The survey was conducted at the end of the even semester of the 2024/2025 academic year, after the completion of science lessons related to issues such as pollution, renewable energy, and environmental degradation. The questionnaire was administered directly in classrooms with the assistance of teachers and researchers to ensure smooth data collection.

The demographic characteristics of participants, including gender distribution and grade level, are presented in **Table 1**.

Table 1 presents the demographic characteristics of the sample. A slightly higher proportion of female students (57.49%) participated compared to male students (42.51%). In terms of grade level, most participants were in Grade 5 (39.76%), followed by Grade 4 (32.42%) and Grade 3 (27.83%). This distribution reflects a balanced representation across the upper primary grades, with a stronger emphasis on students in the higher levels of madrasah ibtidaiyah.

Table 1. An outline of the sample's Characteristics.

Variables		*N*	Percentages
Gender	Male	139	42.51
	Female	188	57.49
	Total	327	100.00
Grades	Grade 3	91	27.83
	Grade 4	106	32.42
	Grade 5	130	39.76
	Total	327	100.00

The instrument used in this study was a closed-ended questionnaire adapted from several previous studies on sustainability awareness (Al Saffar, 2024; Sihombing & Muslim, 2025; Rini & Nuroso, 2024). It consisted of two main sections: (i) demographic information, including gender and grade level, and (ii) ten statement items grouped into three dimensions of sustainability awareness (behavioral and attitudinal awareness, emotional awareness, and awareness of sustainability practices).

Each item was written in both positive and negative forms to test the consistency of responses. A four-point Likert scale was applied, ranging from strongly disagree (1) to strongly agree (4), with reverse scoring for negatively worded items. The items were designed to be simple and communicative, suitable for the cognitive development of elementary students.

To ensure content validity, the instrument was reviewed by three experts and revised based on their feedback. A pilot test was then conducted with 30 students who shared similar characteristics to the main sample. The reliability test yielded a Cronbach's alpha of 0.812, indicating a high level of internal consistency, which is acceptable for this study.

Table 2 summarizes the questionnaire structure and its categorization into the three dimensions of sustainability awareness. Based on **Table 2**, the questionnaire items are organized into three categories: Behavioral and attitudinal awareness (5 items), Emotional awareness (3 items), and Sustainability practice awareness (2 items). This categorization was designed to capture a comprehensive profile of students' sustainability awareness, covering cognitive, affective, and practical dimensions.

Table 2. Questionnaire Category and Item Structure.

No.	Sustainability Awareness Category	No. Item
1	Behavioral and attitude awareness	2,4,8,9,10
2	Emotional awareness	1,3,7
3	Sustainability practice awareness	5,6

After the survey was completed, the data were coded in Microsoft Excel 2023 and analyzed using IBM SPSS Statistics version 24. Descriptive analyses were performed to calculate the mean, standard deviation, frequency, and percentage. Furthermore, normality (Kolmogorov-Smirnov) and homogeneity (Levene) tests were conducted to ensure that the assumptions for parametric tests were met (Pallant, 2020). Once assumptions were satisfied, one-way ANOVA was used to examine differences in sustainability awareness scores based on grade level and gender. The significance level was set at $\alpha = 0.05$.

3. RESULTS AND DISCUSSION

This section addresses the research questions regarding the level of sustainability awareness among madrasah ibtidaiyah students and its variations based on gender and grade

level in Sukabumi Regency. The data were analyzed with respect to grade level, gender, and the three dimensions of sustainability awareness. **Table 3** presents the descriptive statistics of students' sustainability awareness scores by grade level and gender, including the mean, standard deviation, and number of respondents in each subgroup. **Table 3** presents the descriptive statistics of sustainability awareness scores by grade level and gender. Overall, female students exhibited higher average sustainability awareness scores (M = 30.05, SD = 4.007) compared to male students (M = 28.54, SD = 3.975). In terms of grade level, Grade 4 students recorded the highest average score (M = 30.03, SD = 3.663), followed by Grade 3 (M = 29.13, SD = 3.885) and Grade 5 (M = 29.09, SD = 4.435).

Table 3. Descriptive Statistics.

Grade	Gender	Mean	Std. Deviation	N
Grade 3	Female	29.68	3.556	57
	Male	28.21	4.277	34
	Total	29.13	3.885	91
Grade 4	Female	30.56	3.552	61
	Male	29.31	3.728	45
	Total	30.03	3.663	106
Grade 5	Female	29.90	4.682	70
	Male	28.15	3.961	60
	Total	29.09	4.435	130
Toatal	Female	30.05	4.007	188
	Male	28.54	3.975	139
	Total	29.41	4.057	327

Table 4 shows pairwise comparisons of sustainability awareness scores across grade levels using post-hoc analysis. The comparison between Grade 3 and 4 students revealed a mean difference of -0.90 (p = 0.260), indicating no significant difference. Similarly, the comparison between Grade 3 and Grade 5 (mean difference = 0.04, p = 0.997) and between Grade 4 and 5 (mean difference = 0.94, p = 0.174) showed no statistically significant differences. These results confirm that sustainability awareness does not significantly vary across grades 3, 4, and 5

Table 4. Differences Between Classe

(I) Grade	(J) Grade	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Grade 3	Grade 4	-0.90	0.571	0.260	-2.24	0.45
	Grade 5	0.04	0.546	0.997	-1.25	1.32
Grade 4	Grade 3	0.90	0.571	0.260	-0.45	2.24
	Grade 5	0.94	0.523	0.174	-0.29	2.17
Grade 5	Grade 3	-0.04	0.546	0.997	-1.32	1.25
	Grade 4	-0.94	0.523	0.174	-2.17	0.29

Table 5 presents the results of a one-way ANOVA comparing sustainability awareness scores by gender. The results indicate a significant difference between male and female students (F(1, 325) = 11.400, p = 0.001), with females showing higher awareness scores. In contrast, grade level did not produce significant differences (p = 0.158), although descriptively, Grade 4 students had the highest average scores. These findings suggest that gender has a stronger influence on sustainability awareness than grade level in this sample.

Table 5. Differences based on Gender.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	181.804	1	181.804	11.400	0.001
Within Groups	5183.102	325	15.948		
Total	5364.905	326			

These results align with international and local studies showing a female advantage in ecological awareness and sustainable behavior. For example, a large Swedish study of 12–19-year-olds reported a widening gender gap in sustainability awareness, with girls scoring higher even in schools implementing ESD (Olsson & Gericke, 2017). Similar trends were observed in quantitative studies in sport and higher education, where females demonstrated higher levels of knowledge, attitudes, and sustainable behaviors. Furthermore, meta-analyses indicate that gender exerts a small to moderate effect on environmental attitudes, consistently favoring females due to higher empathy and social responsibility. In Indonesia, female students also outperformed males in metacognitive aspects related to environmental cleanliness, supporting findings that ecological awareness is generally higher among girls (Dewi *et al.*, 2020).

The results of this study reinforce the empirical evidence that gender significantly influences sustainability awareness, with female students demonstrating higher awareness than males. This finding underscores the need for a gender-sensitive approach in ESD, ensuring that the potential and needs of each gender are optimally accommodated in sustainable learning programs.

Figure 1 illustrates the mean scores for each questionnaire item (P1–P10) measuring students' sustainability awareness. These values reflect the average level of agreement or awareness for each statement.

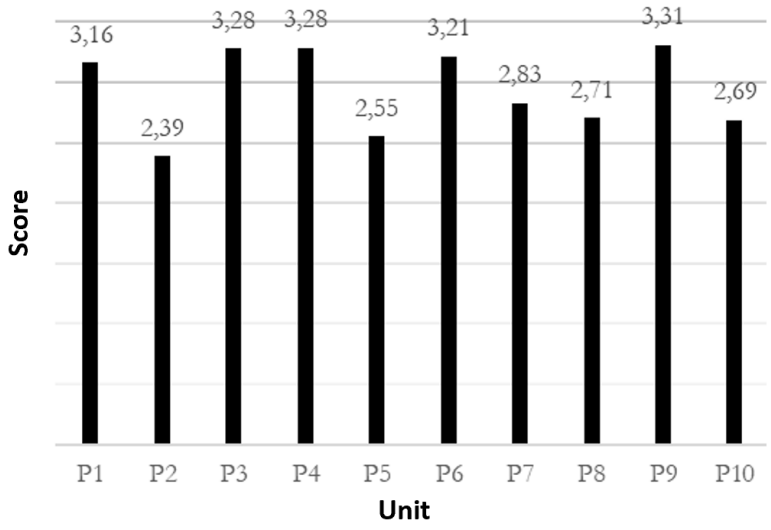

Figure 1. Sustainability Awareness by Indicator.

As shown in **Figure 1**, the highest mean score was obtained for item P9 (M = 3.31), followed by P3 and P4 (both M = 3.28), indicating stronger agreement or awareness in these aspects. Conversely, the lowest scores were observed for item P2 (M = 2.39) and P5 (M = 2.55), suggesting weaker awareness in these areas. Overall, the data reveal varying levels of sustainability awareness across dimensions, with some items approaching moderate to high levels, while others remain relatively low.

Specifically, item P1, "I like reading or watching videos about the environment on social media or the internet", received a mean score of 3.16, indicating a fairly high interest in environmental information through digital media. This finding aligns with the literature (Adnyana & Iswanto, 2021), who demonstrated that social media use positively influences pro-environmental behavior by enhancing environmental knowledge and awareness.

Item P2, "I know that air conditioners and refrigerators can damage the Earth's protective layer (the ozone layer)", obtained the lowest score (M = 2.39), indicating that students' understanding of ozone layer issues remains limited. Items P3 and P4 each scored 3.28, reflecting awareness of the importance of energy conservation and recognition of renewable energy sources such as solar power. Item P5, "I don't feel the need to reduce electricity consumption at home", scored 2.55, suggesting that some students are not fully aware of the importance of reducing energy use.

In contrast, item P6 scored 3.21, indicating that most students habitually turn off lights when not in use. Item P7 scored 2.83, showing that not all students actively encourage their families or friends to save energy. Item P8 scored 2.71, reflecting moderate awareness regarding the limitations of fossil fuel resources. Item P9 received the highest score (M = 3.31), indicating strong awareness in maintaining environmental cleanliness. Item P10 scored 2.69, suggesting that some students do not fully understand the importance of avoiding products that harm the ozone layer.

The overall mean score across all items was 2.95, falling within the moderate range. This indicates that students' general sustainability awareness is moderate, with a tendency towards positive behaviors and attitudes. However, reinforcement is needed, particularly in knowledge acquisition and critical action toward environmental issues.

These findings highlight the importance of connecting global sustainability issues to students' daily lives, both individually and collectively, to motivate real action. Moreover, ESD implementation should employ interdisciplinary, participatory, and action-based thematic approaches, designed to cultivate empathy, critical awareness, and ethical commitment among students (Zahara & Nurrahmi, 2024).

Figure 2 presents the mean scores for each dimension of sustainability awareness, including Behavioral and Attitudinal Awareness, Emotional Awareness, and Awareness of Sustainability Practices. The results, based on **Figure 2**, indicate that the level of students' sustainability awareness is generally in the moderate category, with an overall mean score of 2.95. This suggests that although students show a positive tendency toward sustainability-related issues, they have not yet fully demonstrated a strong understanding and attitude in practice. Therefore, programs aimed at expanding the understanding of ESD beyond simply integrating environmental content are needed. A holistic and transformative learning approach, encompassing curriculum content, pedagogy, and the learning environment, should remain a focus of the Global Action Program (GAP).

Differences in sustainability awareness across grade levels were not statistically significant ($p = 0.158 > 0.05$), although Grade 4 students had the highest average score. This aligns with previous research showing that educational level alone does not necessarily increase environmental awareness unless it is supported by a contextual and participatory learning approach (Chandra Jaya *et al*., 2024). In this context, the limited implementation of project-based learning, exploration, and inquiry at the elementary level may contribute to the stagnation in the development of sustainability awareness across grades.

In contrast, gender analysis revealed a significant difference ($p = 0.001 < 0.05$), with female students consistently demonstrating higher sustainability awareness than males across all

grade levels. This finding aligns with previous studies indicating that females tend to be more concerned about social and environmental issues (Li *et al*., 2022b; Siskawati *et al*., 2023) and exhibit greater empathy and responsibility toward sustainability. Social factors and values embedded in gender roles from an early age are believed to contribute to these differences (Kurniawati & Sa'adah, 2022). Female students are more enthusiastic about environmental and collaborative activities compared to male students (Mukhlis & Herianingtyas, 2021).

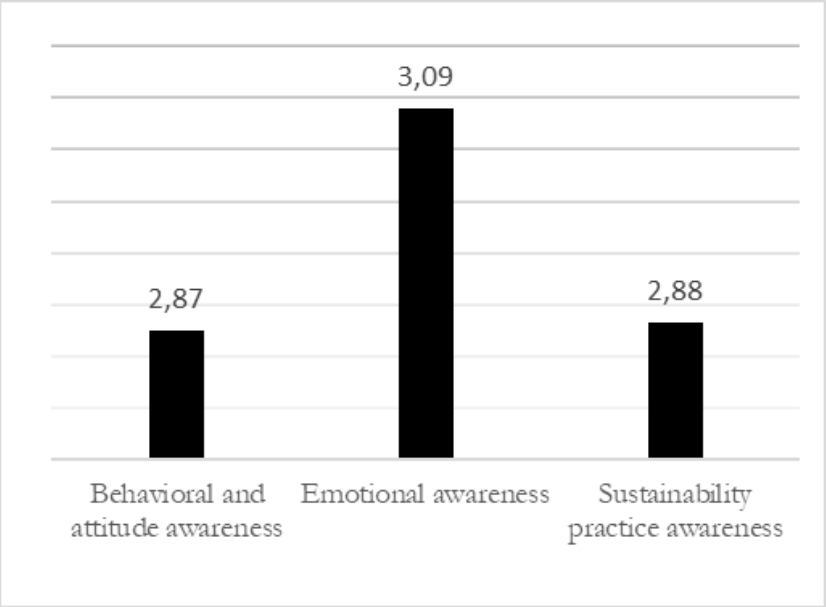

Figure 2. Percentage of Sustainability Awareness by Category.

It is also important to consider that this study was conducted in a madrasah ibtidaiyah, which integrates Islamic values into learning, including responsibility toward God's creation. Interviews with elementary madrasah teachers confirmed that faith-based values are actively embedded in teaching as a foundation for fostering sustainability awareness, particularly in shaping students' attitudes of environmental responsibility.

In-depth interviews were conducted with 12 teachers from four madrasah ibtidaiyah in Sukabumi Regency, with each school represented by one teacher from grades 3, 4, and 5. Interviews were conducted over four days, as the schools were located in different sub-districts. Overall, informants demonstrated a strong understanding of how Islamic faith values shape students' sustainability awareness, emphasizing human responsibility toward other creatures and the universe (Syukri *et al*., 2024).

Grade 3 teachers focused on introducing the basic concept that nature is God's creation and must be protected. One teacher stated, "We teach children that throwing trash in its place is not only a school rule, but also a form of gratitude and respect for God's creation" (Personal interview, 10-13 June 2025). At this stage, the approach emphasizes daily behaviors and habits, such as caring for classroom plants and not damaging school facilities.

Grade 4 teachers emphasized integrating faith values with social and ecological responsibility. One teacher explained, "We teach that humans are caliphs on earth, so they have a duty to protect the environment, such as not cutting down trees carelessly or conserving air" (Personal interview, 10-13 June 2025). At this level, students are introduced to the link between human actions and environmental impact, framed within faith-based values.

Grade 5 teachers adopted a more reflective and conceptual approach. One teacher noted, "We connect lessons of faith with environmental issues, such as natural disasters caused by

human actions, and relate this to QS. Ar-Rum verse 41" (Personal interview, June 10–13, 2025). Students are encouraged to understand the moral and spiritual consequences of human behavior and the importance of acting sustainably as a form of worship.

These findings demonstrate the consistent integration of faith values with the dimensions of sustainability awareness, reinforced through contextual learning and direct practice. This confirms that elementary madrasahs have strong potential to instill sustainability awareness grounded in spiritual values from an early age (Sauri & Sanusi, 2025).

The spiritual values instilled by elementary madrasah teachers in Sukabumi Regency have the potential to strengthen the affective dimension of sustainability awareness, particularly among female students, who tend to be more responsive to moral and religious messages. Based on these findings, a practical recommendation is that elementary madrasahs, with their unique integration of general education and religious values, should design learning experiences that are direct, contextual, and interactive to enhance students' sustainability awareness (Sauri *et al*., 2022; Taufik, 2020).

The spiritual and moral values embedded in Islamic religious learning in madrasahs, such as the concept of responsibility as a caliph on earth, can serve as internal reinforcement for students in developing sustainable attitudes and behaviors (Sokip *et al*., 2019; Jauhari *et al*., 2025). Learning activities should actively involve students in real projects, such as waste management, school energy audits, and energy-saving campaigns, so that students not only understand the concepts but also experience emotional engagement and social responsibility toward the environment. Teachers also need training in developing teaching materials and sustainability-oriented learning approaches that are sensitive to gender differences, enabling every student to be optimally empowered (Irwanto, 2021; Saputro *et al*., 2019). Given the significant role of gender, it is essential to create an inclusive and reflective learning environment that encourages equal participation of both male and female students.

Furthermore, the data indicate that students generally exhibit higher awareness in behavioral and attitudinal aspects, such as turning off lights when not in use (mean = 3.21) or maintaining environmental cleanliness (mean = 3.31), compared to conceptual knowledge aspects, such as understanding the impact of air conditioners and refrigerators on the ozone layer (mean = 2.39). This gap suggests that although students demonstrate positive environmental behaviors, their conceptual understanding of sustainability issues still requires improvement. This finding aligns with previous literature (Anggraini *et al*., 2024), who argue that weak conceptual understanding is often due to limited exploratory learning experiences, particularly in applied and environmental science contexts.

Similarly, descriptive analyses show that gender differences and gaps in conceptual understanding are critical issues that need to be addressed through experiential learning, environmental projects, and contextual approaches that enable students to link daily activities with broader sustainability concepts. This argument is supported by previous literature (Purwanto *et al*., 2020; Strieder Philippsen *et al*., 2017; Husin *et al*., 2025; Ardoin *et al*., 2020), who confirm that active student involvement in environmental-based learning directly enhances awareness, critical thinking, and long-term concern for global issues.

Therefore, efforts to increase sustainability awareness should focus not only on strengthening values and attitudes but also on developing students' conceptual understanding and reflective thinking skills. This is particularly important considering the gender characteristics of madrasah ibtidaiyah students, the integration of religious values, and cross-grade learning approaches. The integration of environmental education with Islamic teachings on social responsibility and nature conservation can serve as an effective

strategy to strengthen overall sustainability awareness (Kurniawan *et al*., 2019; Firdaus, 2024).

Table 6 presents the results of the Pearson correlation analysis among the three dimensions of sustainability awareness: Behavioral and Attitudinal Awareness, Emotional Awareness, and Awareness of Sustainability Practices. Based on **Table 6**, the results of the correlation analysis indicate that all three categories of sustainability awareness (Behavioral and Attitudinal Awareness, Emotional Awareness, and Sustainability Practice Awareness) are positively and significantly correlated with each other at the 0.01 significance level ($p < 0.01$). This suggests that an increase in one variable is generally accompanied by increases in the other variables. The strongest correlation was observed between Behavioral and Attitudinal Awareness and Sustainability Practice Awareness ($r = 0.334$, $p = 0.000$), followed by the correlation between Behavioral and Attitudinal Awareness and Emotional Awareness ($r = 0.295$, $p = 0.000$), and between Emotional Awareness and Sustainability Practice Awareness ($r = 0.290$, $p = 0.000$). Although the correlation values are classified as moderate to low, all relationships are statistically significant, indicating a consistent interconnection among the three aspects measured in this study. This highlights the importance of considering all three dimensions in an integrated manner when developing interventions or conducting further analyses.

Table 6. Correlations between Variables Based on Pearson's Correlation Coefficient.

		Behavioral and attitude awareness	**Emotional awareness**	**Sustainability practice awareness**
Behavioral and attitude awareness	Pearson Correlation	1	0.295**	0.334**
	Sig. (2-tailed)		0.000	0.000
	N	327	327	327
Emotional awareness	Pearson Correlation	0.295**	1	0.290**
	Sig. (2-tailed)	0.000		0.000
	N	327	327	327
Sustainability practice awareness	Pearson Correlation	0.334**	0.290**	1
	Sig. (2-tailed)	0.000	0.000	
	N	327	327	327

Note: ** is the Correlation is significant at the 0.01 level (2-tailed).

These findings align with previous studies. A meta-analysis among Spanish students found positive correlations between knowledge-attitude and knowledge-behavior, with an even stronger correlation between attitude and behavior (Dopelt *et al*., 2019). Subsequent research in the contexts of sport and higher education also reported positive correlations between sustainability awareness and environmental behavior (Eraslan *et al*., 2024). Studies in Taiwan, as well as meta-analyses on environmental knowledge, attitudes, and intentions, similarly confirmed positive correlations among these variables with high levels of significance (Liang *et al*., 2018; Berglund *et al*., 2020). Furthermore, the 'cognitive-emotional-behavioral' theory in ESD emphasizes the interconnection among these three dimensions: knowledge (cognition), emotional awareness (emotion), and sustainable practices (behavior), and their interactions as essential for supporting sustainable socio-ecological change (Ding *et al*., 2022).

Thus, although the correlations are moderate to low, their statistical significance reflects an important interdependent structure. This implies that in designing ESD interventions, all

three aspects (cognitive and attitudinal, emotional, and practical should be addressed in an integrated manner to maximize the effectiveness of sustainability education programs in madrasah ibtidaiyah.

4. CONCLUSION

This study provides an overview of the level of sustainability awareness among elementary school students and examines differences based on grade and gender. The results indicate that students' overall sustainability awareness is in the moderate category, with an average score of 2.95. Although students exhibit positive environmental behaviors, their conceptual understanding of sustainability issues remains limited, particularly regarding energy sources and their environmental impacts. There was no significant difference between grade levels, whereas female students demonstrated significantly higher levels of sustainability awareness than male students across grades 3, 4, and 5. These findings suggest that gender has a stronger influence than grade level in shaping students' sustainability awareness. Additionally, Pearson correlation results show that grade, gender, and sustainability awareness are significantly interrelated ($p = 0.000$), highlighting the importance of considering these variables in efforts to strengthen sustainability education at the elementary level.

For future development, further research could explore the effectiveness of specific learning models such as project-based learning, experiential learning, or STEAM-ESD in enhancing students' sustainability awareness. Longitudinal studies are also recommended to track changes in awareness over time. Moreover, because this study was limited to a single population of madrasah ibtidaiyah students, generalization of the findings remains limited. Future studies should involve schools from diverse social, cultural, and geographical contexts to provide a more representative understanding of sustainability awareness among Indonesian elementary students.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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