Needs Analysis of a Green Sustainability Module in Design and Technology (D&T) for Enhancing Student's Green Knowledge and Practices

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DOI: https://doi.org/10.47772/IJRISS.2026.10100566

Received: 24 January 2025; Accepted: 29 January 2026; Published: 17 February 2026

ABSTRACT

Despite the growing emphasis on sustainability within Malaysia's education system, students' understanding and application of green skills remain limited.This study adopted the ADDIE instructional design model, focusing specifically on the needs analysis phase, to examine the necessity of developing a Green Sustainability Module for the lower secondary Design and Technology (D&T) subject.The use of the latest technology has become a necessity in implementing effective and holistic teaching and learning. This has also been emphasized by various previous studies that show that the integration of technology not only enhances the effectiveness of teaching and learning but also stimulates active and meaningful student engagement. In the context of the Design and Technology (D&T) subject, conventional approaches are no longer sufficient to instill a deep understanding of sustainability issues. Therefore, the development of the Green Sustainability Module should be designed with current educational technologies in mind, such as digital simulations, project-based learning (PBL), and interactive multimedia resources that provide an authentic and comprehensive learning experience.A mixedmethods approach was employed, involving a questionnaire survey of 231 Form Two students from selected public secondary schools in Selangor, complemented by semi-structured interviews with seven experts from education and industryDescriptive statistical analysis showed minimal levels of awareness (M = 1.66, SD = 0.607), practice (M = 1.45, SD = 0.543) and attitude (M = 1.61, SD = 0.513) towards environmental skills among learners. Teachers' integration of green skills into their teaching was also minimal (M = 1.57, SD = 0.052). Inferential analysis further indicated a significant difference in students' green knowledge based on mothers' educational level ($p < 0.05$), suggesting the potential influence of socio-economic background.Experts emphasised the urgent need for a structured, project-based, interdisciplinary green module to raise awareness and encourage behavioural change among students. The study therefore concludes that a structured, projectbased Green Sustainability Module is both necessary and timely to enhance students' green literacy, promote sustainable practices, and support teachers in integrating sustainability more systematically within D&T education.

Keywords: Green skills, Sustainability, Design and Technology (D&T), Need Analysis, ADDIE, Environmental Education

INTRODUCTION

Sustainability education has become a global priority, as reflected in international frameworks such as the United Nations Sustainable Development Goals (SDGs) (United Nations, 2017). Educating younger generations about sustainability is widely recognised as essential for ensuring long-term environmental well-being and fostering responsible citizenship. In Malaysia, the Ministry of Education has progressively integrated sustainabilityrelated elements into the national curriculum, reflecting the government's commitment to nurturing environmentally conscious and socially responsible citizens (Mokshein, 2019). However, despite these policy initiatives, empirical studies indicate that students' awareness, attitudes, and practices related to green skills remain limited, particularly among lower secondary students in the Design and Technology (D&T) subject (Ismail, 2022). This

highlights a persistent gap between curriculum intentions and students' actual engagement with sustainable practices.

The Fourth Industrial Revolution (IR 4.0) has further increased the need for students to possess not only technical competencies but also environmental literacy, critical thinking, and problem-solving skills. Conventional teaching methods in D&T are often insufficient to instil a deep understanding of sustainability concepts or to encourage meaningful behavioural change. Studies suggest that student-centred, project-based, and technology-enhanced pedagogical approaches are more effective in fostering active learning and authentic understanding (Thomas, 2000; Kolb, 2015). The emergence of the Fourth Industrial Revolution (IR 4.0) highlights the importance of equipping students with competencies that go beyond technical skills (Cheok & Li, 2022). Modern industries increasingly require employees who possess environmental literacy, critical thinking and problem-solving abilities, as well as the capacity to implement sustainable solutions in real-world contexts (Ramli et al., 2025). In the context of secondary school education, traditional teaching methods are insufficient for fostering a deep understanding of sustainability issues. Students need interactive, project-based learning experiences that align with technological advancements in order to engage meaningfully with environmental challenges (Mokshein, 2019; Ismail, 2022).

Despite these policy efforts, empirical studies continue to reveal persistent shortcomings in students' green competencies, particularly in lower secondary levels. A recent scoping review into sustainability competency development in secondary education made the finding that many interventions remain overly focused on cognitive understanding, with insufficient attention to affective and behavioural dimensions such as real-life application and habit formation (Sposab et al., 2024). In Malaysia, attempts to incorporate green skills into curricula, especially in technical and vocational subjects, are hindered by unclear definitions of green skills, limited resources, and a lack of alignment between educational objectives and industry expectations (Iqbal & Rahim, 2024; Safee, 2024). To address these issues, educational interventions must evolve from merely integrating content to designing comprehensive modules that systematically develop knowledge, attitudes, and sustainable practices. Integrating active pedagogical approaches, such as design thinking, project-based learning and real-world problem solving, has been shown to strengthen student agency and deepen environmental literacy in more authentic contexts (Ardila Echeverry et al., 2025).

This study therefore focuses on conducting a needs analysis to develop a Green Sustainability Module within Design and Technology (D&T). The module is intended to strengthen student knowledge, enhance sustainable practices and promote active, student-centred learning approaches. The module integrates interdisciplinary content, hands-on activities and contemporary educational technologies to provide an authentic learning experience that prepares students to contribute responsibly to environmental stewardship (Cheok & Li, 2022). Furthermore, identifying the existing knowledge, attitude and practice gaps among students is essential for designing contextually relevant and effective interventions that cultivate green skills from an early age (Ramli et al., 2025).

Global and Malaysian Perspectives on Sustainability Education

Education for Sustainable Development (ESD) has been globally recognised as a critical agenda in preparing future generations to address environmental, economic, and social challenges. According to UNESCO (2017), ESD empowers learners with the knowledge, competencies, values, and attitudes necessary for responsible decision-making that fosters sustainability at individual, community, and global levels. The United Nations Sustainable Development Goals (SDGs), particularly SDG 4.7, further emphasise the role of education in equipping learners with the skills needed to promote sustainable practices, global citizenship, and respect for cultural diversity (United Nations, 2017).

Globally, the implementation of ESD has taken diverse forms, ranging from curriculum integration in developed countries to project-based and community-oriented initiatives in developing contexts (Leicht et al., 2018). European and East Asian nations, for example, have embedded sustainability literacy within technical and vocational education programmes, recognising the growing demand for a workforce equipped with competencies relevant to sustainable industries (Rieckmann, 2018).

In Malaysia, the Ministry of Education has incorporated sustainability elements into national policy frameworks such as the Malaysia Education Blueprint 2013–2025 and the Secondary School Standard Curriculum (KSSM), with an emphasis on critical thinking, creativity, and values-based learning. However, the integration of structured and practice-oriented green skills within subjects such as Design and Technology (D&T) remains limited (Mokshein, 2019). Previous studies indicate that although Malaysian students demonstrate increasing awareness of environmental issues, their practical skills and consistent behavioural application of green practices remain insufficient (Abdullah et al., 2020; Yusof & Hashim, 2021). This gap between theoretical understanding and authentic behavioural change highlights the need for structured instructional modules that systematically address both sustainability knowledge and practical application.

Transforming TVET Education: Innovative Pedagogies for Sustainability

Sustainability education requires innovative, student-centred pedagogical approaches that foster meaningful engagement and long-term learning outcomes. Traditional lecture-based methods are often insufficient in promoting sustained awareness or behavioural change related to sustainability issues (Abdullah et al., 2020). In contrast, pedagogical approaches such as project-based learning (PBL), inquiry-based learning, and experiential learning have been shown to be effective in enhancing students' problem-solving abilities, critical thinking, and collaborative skills (Thomas, 2000; Kolb, 2015).

Technical and Vocational Education and Training (TVET) provides a particularly suitable platform for embedding sustainability within authentic and applied learning contexts. Integrating sustainability principles into TVET enables learners to connect theoretical concepts with practical applications, including resource efficiency, renewable energy practices, and eco-friendly product design (Ramlee & Daud, 2018). Moreover, sustainability-oriented TVET education not only strengthens technical competencies but also promotes ethical awareness and responsible decision-making, thereby preparing students to meet the demands of the Fourth Industrial Revolution (IR 4.0) (Cheok & Li, 2022).

The interdisciplinary nature of sustainability further underscores the importance of integration across multiple subject areas. For instance, the integration of Design and Technology (D&T) with science and environmental education encourages learners to adopt holistic perspectives when addressing complex sustainability challenges (Ismail, 2022). Such interdisciplinary approaches ensure that TVET education extends beyond the development of technical skills to include environmental literacy, critical reflection, and sociocultural awareness, all of which are essential for fostering sustainable practices.

Design and Technology (D&T) Education in Sustainability and the Role of Educational Technology

Design and Technology (D&T) education offers significant opportunities for embedding sustainability within Malaysia's secondary school curriculum. The subject inherently integrates theoretical knowledge with practical application through activities such as design projects, material selection, and product testing. When aligned with sustainability principles, D&T enables students to engage with concepts such as eco-design, waste reduction, recycling, and energy efficiency in authentic, hands-on learning contexts (Ismail, 2022; Cheok & Li, 2022).

Educational technology further enhances sustainability learning by providing experiential opportunities that may be difficult to achieve through conventional classroom instruction alone. Tools such as digital simulations, augmented reality (AR), virtual reality (VR), and interactive multimedia allow learners to visualise complex sustainability concepts and experiment with solutions in controlled and safe environments (Ramli et al., 2025). For instance, virtual laboratories can simulate renewable energy systems, while gamified learning platforms can promote positive behavioural changes related to recycling and energy conservation.

The integration of educational technology in D&T also aligns closely with the competencies required in the Fourth Industrial Revolution (IR 4.0), including digital literacy, innovation, and adaptability. Consequently, embedding sustainability within D&T through the strategic use of educational technology ensures that students develop not only essential green skills but also the digital competencies needed to thrive in an increasingly technology-driven economy.

The Need for a Green Sustainability Module in D&T (Form 2)

Despite strong national and global emphasis on Education for Sustainable Development (ESD), empirical evidence indicates that Malaysian secondary school students continue to demonstrate relatively low levels of green literacy, particularly in translating sustainability knowledge into consistent daily practices (Abdullah et al., 2020; Yusof & Hashim, 2021). While the current Design and Technology (D&T) curriculum incorporates elements of environmental awareness, it lacks a structured and comprehensive module specifically dedicated to sustainability education (Mokshein, 2019). Consequently, students may possess basic conceptual knowledge, such as awareness of recycling, yet fail to consistently practise behaviours such as waste segregation or energy conservation.

The development of a Green Sustainability Module tailored for Form Two D&T is therefore essential to address these gaps. Such a module would integrate sustainability concepts with hands-on projects, inquiry-based learning activities, and the use of digital tools to support active and experiential learning. In addition, the module would align with Malaysia's policy commitments to the Sustainable Development Goals (SDGs) and the competencies required for the Fourth Industrial Revolution (IR 4.0), thereby equipping students with both technical and environmental skills relevant to contemporary societal needs.

Furthermore, a structured sustainability module would provide practical support for teachers by offering clear content guidelines, pedagogical strategies, and appropriate assessment tools to facilitate effective classroom implementation (Cheok & Li, 2022). Ultimately, the implementation of such a module has the potential to promote meaningful behavioural change among students and to foster environmentally responsible citizens capable of contributing to Malaysia's broader sustainable development agenda.

3.0 Methodology

This chapter presents the methodology of the study. It outlines the research design, describes the participants, explains the instruments used for data collection, details the procedures followed, and discusses the techniques applied for data analysis. The purpose of this chapter is to provide a clear and systematic description of how the Green Sustainability Module needs analysis was conducted form two students in Design and Technology (D&T).

3.1 Research Design

A mixed-methods approach was adopted to gain a comprehensive understanding of students' green skills literacy, allowing for the triangulation of quantitative and qualitative findings. The study employed the ADDIE instructional design model, with a focus on the needs analysis phase. This approach ensured that the development of the proposed Green Sustainability Module would be both evidence-based and contextually relevant. The ADDIE model consists of five phases: I – Analysis Phase, II – Design Phase, III – Development Phase, IV – Implementation Phase, and V – Evaluation Phase.

Fig.1: Phases in ADDIE Model of Instructional Design

Respondents of the study

The study involved a total of 231 Form Two students from selected public secondary schools in Selangor. The respondents comprised 43.3% male and 56.7% female students. In terms of ethnicity, 67.5% were Malay, 19.5% were Chinese, and 13.0% were of Indian descent. With regard to parental education, the majority of mothers (56.7%) and fathers (65.8%) had attained a bachelor's degree. Most households (76.2%) reported a monthly income exceeding RM6,000, suggesting that the respondents generally came from a relatively high socioeconomic background.

Participants were selected using purposive sampling to ensure the inclusion of Design and Technology (D&T) students who could provide meaningful insights into sustainability practices and green skills. The selection process also considered demographic diversity, allowing for meaningful comparisons across gender, ethnicity, and parental educational background. In addition, interviews were conducted with seven experts, including teachers, lecturers, and industry professionals with experience in sustainability education and technical subjects. Their perspectives were used to validate the survey data, enhancing the credibility and relevance of the study's findings.

Research instrument

Structured Questionnaire

A structured questionnaire was developed based on previous studies and validated by field experts to ensure content validity. The questionnaire was designed to assess the knowledge, practices, and attitudes of Form Two students towards green skills and sustainability within the Design and Technology (D&T/RBT) subject. It consisted of four sections, as shown in Table 1.

Table 1 Questionaire's section

SECTION	CONSTRUCT
A	Demographic Information (gender, ethnicity, parental education, household income).
B	Knowledge of Green Skills and Sustainable Practices
C	Practices of Green Skills

The questionnaire items were adapted from previous studies (Abdullah et al., 2020; Yusof & Hashim, 2021) and validated by seven field experts to ensure content validity and clarity. A pilot study was conducted with 30 students to assess reliability, with Cronbach's alpha values ranging from 0.78 to 0.85, indicating acceptable internal consistency. A five-point Likert scale was used in the questionnaire, with the points defined as Strongly Agree (5), Agree (4), Uncertain (3), Disagree (2), and Strongly Disagree (1). Data were analysed using the Statistical Package for the Social Sciences (SPSS) software, version 28.0. Demographic data were examined using descriptive statistics, including frequency, percentage, minimum value, and standard deviation. Table 2 presents the interpretation of the mean scores for the responses, based on the framework proposed by TschannenMoran and Gareis.

Table 2 Min Value according to five Likert scale

Min Score Value	Interpretation
1.00 - 1.80	Very Low
1.81 - 2.60	Low

2.61 - 3.40	Moderate
3.41 - 4.20	High
4.21 - 5.00	Very High

Semi-Structured Interviews

Semi-structured interviews were conducted with seven experts, including teachers, lecturers, and industry professionals. The interview protocol focused as shown in Table 3.

Table 3

SECTION	CONSTRUCT
A	Assessing student's awareness, attitudes and practices regarding skills..
B	Exploring the effectiveness of Current Pedagogical approaches in D&T
C	Obtaining recommendations for developing a Green Sustainability Module for Form Two Students.

The interviews were recorded, transcribed, and analysed thematically to complement and triangulate the quantitative findings from the questionnaire. This mixed-methods approach ensured a comprehensive understanding of students' needs and the contextual factors influencing sustainability education.

Data Collection Procedure

Data were collected using questionnaires, which were administered in the classrooms. Interviews were conducted either online or face-to-face, depending on the participants' availability. Ethical considerations were strictly observed, with informed consent obtained from both students and their parents. The anonymity and confidentiality of the participants were maintained throughout the study.

Data analysis

Quantitative data were analysed using SPSS version 28. Descriptive statistics were calculated to examine students' knowledge, attitudes and practices, while inferential tests such as t-tests and ANOVAs were used to explore differences across demographic variables, including gender, ethnicity and parental education. Qualitative data from interviews were transcribed and analysed thematically, enabling triangulation with the survey findings. This mixed-methods approach provided a robust understanding of students' green skills literacy and informed recommendations for developing the Green Sustainability Module.

This study employed the ADDIE instructional design model, focusing on the initial needs analysis phase. A total of 231 Form Two students from public secondary schools in Selangor participated in the survey. The sample was 43.3% male and 56.7% female; 67.5% were Malay, 19.5% Chinese and 13.0% Indian. The parents' educational backgrounds varied, with most mothers (56.7%) and fathers (65.8%) holding a bachelor's degree. Most parents (76.2%) earned more than RM6,000 per month, suggesting relatively high socioeconomic backgrounds. Data were collected using a structured questionnaire designed based on previous literature and validated by field experts to ensure content validity.

The questionnaire assessed students' knowledge, practices and attitudes towards green skills, as well as teachers' integration of environmental education in Design and Technology (D&T) lessons. The data were analysed using SPSS version 28, with descriptive statistics calculated for the knowledge, practice and teaching variables. Inferential tests, including t-tests and ANOVA, were employed to explore differences in green skills literacy according to demographic factors such as gender, ethnicity, and parental education level. Additionally, semi-

structured interviews were conducted with seven experts, including teachers, lecturers, and industry professionals, to corroborate the quantitative findings and provide qualitative insights into current practices, challenges, and recommendations for implementing a Green Sustainability Module. These interviews explored the experts' perceptions of students' awareness, the effectiveness of current pedagogical approaches and potential strategies for improving sustainability education in D&T. Furthermore, ethical considerations were strictly observed throughout the study. Informed consent was obtained from both students and their parents, and the anonymity and confidentiality of participants were ensured. A mixed-methods approach combining quantitative surveys and qualitative interviews was chosen to provide a comprehensive understanding of students' green skills literacy needs and gaps, ensuring the module's development is evidence-based and contextually relevant.

Respondent's Demographic Profile

The respondents of this study consisted of 231 Form Two students from selected public secondary schools in Selangor. The demographic profile of the participants was as follows in Table 4: 43.3% male and 56.7% female students; 67.5% Malay, 19.5% Chinese, and 13.0% Indian. Regarding parents' education levels, the majority of mothers (56.7%) and fathers (65.8%) held a bachelor's degree. In terms of household income, most parents (**76.2%**) earned more than RM6,000 monthly, indicating relatively high socio-economic backgrounds

Table 4 Respondent's demographic information

Item	Category	Frequency	Percentage (%)
Gender	Male	100	43.3
Ethnicty	Female	131	56.7
Mother's Educaion	Total	231	100.0
	Malay		
	Chinese		
	Indian		
Bachelor's Degree	131		56.7
Others	100		43.3
Father's Education	152		76.2
Bachelor Degree	79		23.8
Others	176		
Household Income RM 6000	55		
≤ RM 6000			

A normality test using skewness and kurtosis was performed to evaluate whether the distribution of the data was normal or abnormal. The table shows that the values of skewness and kurtosis for the constructs ranged between -2.00 and 2.00, indicating that the data was normally distributed. According to Hair et al. (2019), data are considered normally distributed when the Skewness and Kurtosis values fall within the range of ±1.00. Table 5

presents the normality test results. The Skewness values for the constructs ranged from -0.756 to -0.520, while the Kurtosis values ranged from -0.675 to -0.475.

Specifically, the Skewness and Kurtosis values for Green Skills Knowledge were -0.756 and -0.475 respectively, for Green Skills Practices were -0.520 and -0.675, and for Green Skills Teaching were -0.686 and -0.575. Since all values fall within the acceptable range, the results confirmed that the dataset was normally distributed and suitable for subsequent parametric analyses.

Table 5 Results of normality testa using Skewness and Kurtosis

Section	Construct	Values of normality test	
		Skewness	Kurtosis
B	Green Skills Knowledge	- 0.756	-0.475
C	Green Skills Practices	- 0.520	-0.675
D	Green Skills Teaching	- 0.686	-0.575

Student's knowledge of Green Skills

This section of the questionnaire contains twelve items designed to assess students' knowledge of green skills. These items focus on students' understanding of key sustainability concepts, such as waste management, energy efficiency, water conservation, the use of eco-friendly materials and the 3Rs (reduce, reuse, recycle). Descriptive statistics, including the mean and standard deviation, were used to analyse respondents' level of knowledge. Mean scores were interpreted on a scale ranging from 1.00 to 3.00, with lower scores indicating limited understanding of green skills. These constructs were selected based on the core elements of environmental education embedded within the Design and Technology (D&T) curriculum.

Item Code	Item	Mean	SD	Interpretation
B1	I know the importance of protecting the environment to prevent frequent natural disasters.	1.84	0.751	Low
B2	I know that green campaigns such as Go Green and Save Mother Earth aim to raise public awareness of green living.	1.40	0.565	Very Low
B3	I can list three main green skills: recycling, using ecofriendly materials, and energy conservation.	1.92	0.908	Very Low
B4	I know how to separate food waste and solid waste according to categories (such as food, paper, plastic, and glass) before disposal.	1.11	0.338	Very Low
B5	I know the importance of switching off lights, air conditioners, and fans when not in use to save energy from fuel sources.	1.44	0.713	Low

B6	I know that throwing rubbish or toxic substances into rivers can kill aquatic life and pollute the water.	1.15	0.405	Very Low
B7	I know that rainwater can be collected and used for cleaning or watering plants.	2.38	0.486	Moderate
B8	I know that global warming will occur if many trees are cut down and forests are cleared.	1.35	0.578	Very Low
B9	I know that the use of plastics materials, including polystyrene (such as plastics,bags, straws and food containers), causes pollution because plastic is nonbiodegradable.	1.12	0.327	Very Low
B10	I know that open burning causes air pollution and contributes to global warming.	1.19	0.494	Very Low
B11	I know that reusing discarded materials to produce useful products can prevent waste and reduce garbage disposal.	1.15	0.405	Very Low
B12	I know that recycling helps separate waste, save enegry and reduce greenhouse gas emissions.	1.82	0.894	Very Low
Overall		1.45	0.543	Very Low

Table 3.7 : Student's knowledge of Green Skills

The findings revealed in table 3.7 that students possessed a very low level of knowledge regarding green skills (M = 1.45, SD = 0.543). Although students demonstrated some awareness of simple environmental actions such as saving electricity and collecting rainwater, their understanding of more complex sustainability concepts such as waste segregation, recycling processes, and plastic pollution remained limited. This suggests that students' environmental knowledge is mostly surface-level and lacks depth in conceptual understanding.

The results indicate that environmental topics are not sufficiently emphasised within the current D&T curriculum, leading to fragmented awareness without comprehensive understanding. Therefore, there is an urgent need for a structured and interactive Green Sustainability Module that can strengthen students' conceptual and practical knowledge through project-based, inquiry-driven, and technology-integrated approaches to enhance green literacy from an early stage.

Students' Practice of Green Skills

Item Code	Item	Mean	SD	Interpretation
C1	I practise environmental care to prevent frequent natural disasters on Earth.	1.90	0.690	Low
C2	I actively participate in school-organised green campaigns such as the Green Sustainability Campaign, 3R Campaign, and Green Earth Programme.	1.22	0.443	Very Low

C3	I practise green skills at school, such as recycling, using eco-friendly materials, and saving energy.	1.19	0.494	Very Low
C4	I separate food and solid waste into categories (such as food, paper, plastic, and glass) before disposal.	1.15	0.405	Very Low
C5	I switch off lights, air conditioners, and fans when not in use.	1.82	0.894	Low
C6	I avoid throwing rubbish into rivers to prevent aquatic life from dying and to maintain water quality.	1.15	0.405	Very Low
C7	I collect rainwater to use for cleaning and watering plants.	2.38	0.486	Moderate
C8	I I plant more trees to reduce the effects of global warming.	1.35	0.578	Very Low
C9	I bring my own reusable bag when shopping to reduce the use of plastic bags..	1.12	0.327	Very Low
C10	I avoid open burning to prevent air pollution and global warming.	1.19	0.494	Very Low
C11	I use waste materials to create useful products to prevent wastage and reduce garbage disposal.	1.15	0.405	Very Low
C12	I practise the 3R concept (Reduce, Reuse, Recycle) in my daily activities.	1.82	0.894	Low
Overall		1.45	0.543	Very Low

Table 3.8 : Student's Practice of Green Skills

The findings in Table 3.8 reveal that students' practice of green skills is at a very low level, with an overall mean score of M = 1.45, SD = 0.543. This indicates that although students have a certain level of environmental awareness, they rarely apply these practices in their daily routines. The highest mean was recorded for *collecting rainwater for daily use* (M = 2.38, SD = 0.486), showing that this practice is relatively easier and more common among students. However, the lowest mean values were found for *practising green skills at school* (M = 1.19, SD = 0.494) and *participation in school-organised campaigns* (M = 1.22, SD = 0.443), suggesting that students are less involved in structured sustainability activities.These results imply that environmental practices have not yet become part of students' daily habits. Thus, structured learning modules such as the Green Sustainability Module are essential to encourage consistent behavioural changes and promote environmental responsibility among secondary school students.

Teachers' Integration of Green Skills in School

Table 3.9: Teachers' Integration of Green Skills in School

Here is your data converted into a clean, properly formatted table:

No.	Item Statement	Yes	No	Mean (M)	Standard Deviation (SD)	Interpretation
1	My teacher instructs students to practise environmental care in school, such as not littering.	231 (100%)	0 (0%)	1.00	0.000	Always Practised
2	My school organises campaigns such as Green Sustainability Campaigns, 3R Campaigns, and Green Earth Campaigns.	45 (19.5%)	186 (80.5%)	1.85	0.415	Rarely Practised
3	My teacher practises green skills such as water conservation, energy saving, environmental protection, and 3R practices.	231 (100%)	0 (0%)	1.00	0.000	Always Practised
4	My teacher teaches students to separate food and solid waste according to categories (such as food, paper, plastic, and glass) before disposal.	11 (4.8%)	220 (95.2%)	1.95	0.213	Rarely Practised
5	My school provides different bins for waste separation (such as bins for food waste, paper, and plastic).	231 (100%)	0 (0%)	1.00	0.000	Always Practised
6	My teacher instructs students to switch off lights, fans, and air conditioners when not in use.	231 (100%)	0 (0%)	1.00	0.000	Always Practised
7	My teacher forbids students from throwing rubbish or toxic substances into rivers to protect aquatic life and water quality.	231 (100%)	0 (0%)	1.00	0.000	Always Practised
8	My teacher instructs students to plant more trees to green the school environment.	0 (0%)	231 (100%)	2.00	0.000	Never Practised
9	My teacher encourages students to bring their own non-plastic bags when shopping to reduce the use of plastic bags.	0 (0%)	231 (100%)	2.00	0.000	Never Practised

10	My teacher reminds me not to carry out open burning to prevent air pollution that can harm human health.	0 (0%)	231 (100%)	2.00	0.000	Never Practised
11	My teacher instructs students to recycle discarded materials to produce useful products and reduce waste.	0 (0%)	231 (100%)	2.00	0.000	Never Practised
12	My teacher practises the 3R concept (Reduce, Reuse, Recycle) in daily school activities.	0 (0%)	231 (100%)	2.00	0.000	Never Practised
Average				**1.57**	**0.052**	**Rarely Practised**

The findings in Table 3.9 indicate that the overall mean score for teachers' integration of green skills in school was M = 1.57, SD = 0.052, which reflects a rarely practised level. This result suggests that while some environmental practices such as keeping the school clean, switching off electrical appliances, and water conservation are consistently implemented, other aspects like tree planting, waste segregation, and recycling projects are not actively conducted. The items with the lowest mean values (M = 1.00) demonstrate that teachers frequently remind students to maintain cleanliness and conserve energy, showing consistent efforts in basic environmental practices. However, the highest mean values (M = 2.00) for items related to tree planting and recycling activities indicate that such practices are rarely implemented in the school setting.

These findings are consistent with Zuhaili (2023), who emphasised that teachers play a crucial role in modelling and reinforcing sustainability practices, but many schools still lack structured programmes to ensure consistent implementation. Therefore, the development of a Green Sustainability Module is essential to guide teachers in embedding green practices through project-based and experiential learning approaches, ensuring long-term behavioural impact on students.

CONCLUSION

The findings of this needs analysis highlight a critical gap in students' understanding, practice, and application of green skills within the Design and Technology (D&T) subject at the lower secondary level. Despite sustainability themes being included in Malaysia's national curriculum, the results show that students' overall knowledge (M = 1.45, SD = 0.543), their practical application of green skills (M = 1.45, SD = 0.543) and their teachers' integration of these skills (M = 1.57, SD = 0.052) are all at a very low level. This suggests that environmental education within D&T is mostly theoretical and lacks practical involvement, leading to limited behavioural change among students.

The investigation further emphasises that while learners display restricted knowledge of fundamental ecological practices, such as preserving energy or amassing rainwater, their comprehension of more intricate sustainability concerns, including waste administration, reuse, and contamination avoidance, is deficient. Teachers, on the other hand, consistently promote cleanliness and energy-saving behaviour, but lack structured guidance on how to embed sustainability holistically within classroom activities. This situation reflects a disconnect between policy intentions and actual classroom implementation, confirming the need for a transformation in pedagogy.

The results collectively emphasise the urgent necessity of a structured, evidence-based Green Sustainability Module tailored to the D&T curriculum. This module should use project-based learning, inquirydriven strategies and educational technologies to increase student engagement, improve conceptual understanding and encourage the practical application of green skills. Furthermore, it should serve as a practical guide for teachers by

providing clear instructional frameworks, assessment tools and experiential learning activities that align with the Sustainable Development Goals (SDGs) and Malaysia's IR4.0 educational vision.

In conclusion, this study provides a strong foundation for the development phase of the ADDIE model. It confirms that the introduction of a Green Sustainability Module is both necessary and timely. The module has the potential to transform D&T education into a platform that nurtures environmentally literate, responsible, and future-ready citizens who contribute actively to Malaysia's sustainable development agenda by addressing existing gaps in knowledge, practice, and pedagogy.

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