
Greening the Building Construction Industry: Sustainability Consciousness of Building Technology Education Would-Be Professionals

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Abstract: Despite the growing global emphasis on sustainable construction practices and the increasing urgency to minimize the environmental footprint of the construction industry, there remains a critical question mark regarding the preparedness, knowledge, and awareness of certain future professionals – Building Technology Education students. The lack of clarity on whether these students possess adequate knowledge, skills, and a mindset geared towards eco-friendly practices forms the crux of the problem. This study aimed to investigate and address this gap in understanding the sustainability consciousness of Building Technology Education students using a descriptive survey design and adopted the Sustainability Consciousness Questionnaire (SCQ) as an instrument for data collection. Cronbach alpha reliability test of the instrument yielded a satisfactory $\alpha = 0.841$. Findings across knowingness, attitudes, and behaviours related to sustainability, reveal that students demonstrated alignment and agreement, indicating not only a robust understanding of sustainability concepts but also a positive inclination and active engagement in behaviours supporting sustainability initiatives. Moreover, comparing academic years revealed a significant difference in sustainability consciousness between final-year students and those in earlier academic stages. This highlights the evolving nature of sustainability awareness throughout the educational journey, suggesting that sustainability consciousness becomes more pronounced as a student progresses in study. These insights are invaluable for educators, institutions, and policymakers, indicating the need for continuous reinforcement of sustainability education and practices throughout the BTE curriculum to foster a more comprehensive and consistent sustainability consciousness among these future professionals, towards greening the building construction industry.

Keywords: Sustainability, Greening, Sustainability Consciousness, Building Technology Education

1. Introduction

The construction industry stands as a bastion of progress and innovation, yet its impact on the environment has been a growing concern. Embracing sustainability has become the clarion call for change, urging a shift towards greener practices within the building construction sphere [1, 2]. At the forefront of this transformation are the future builders, draughtsmen, foremen, and technologists - the students of building technology education, whose role in fostering sustainability consciousness within the industry cannot be

overstated. This pivotal group represents the torchbearers of change, responsible for moulding not just the very landscapes we inhabit, but the mindsets of learners under their tutelage. However, the extent of their awareness and preparedness to champion eco-friendly practices remains a pivotal question, marking a significant gap in the endeavour to "green" the building construction industry.

Greening the building construction industry in Nigeria represents a transformative journey towards sustainable practices, emphasizing eco-friendly materials, energy-efficient designs, and innovative technologies [3]. This

endeavour is propelled by the urgent need to mitigate environmental impact, optimize resource utilization, and foster resilient infrastructure. It involves a multifaceted approach encompassing policy frameworks, educational reforms, technological advancements, and industry collaborations aimed at integrating green building standards, reducing carbon emissions, enhancing waste management systems, and promoting renewable energy adoption [3]. By prioritizing sustainability in construction projects, nations seek to not only address environmental challenges but also stimulate economic growth, improve quality of life, and create a lasting legacy of environmentally responsible urban development across its diverse landscapes [4-6]. Achieving this feat requires that individuals have the knowledge and experience of what sustainability represents.

According to the World Council on Environment and Development (WCED) [7], sustainability is the ability to satisfy present demands without compromising the potential of future generations to satisfy their own needs. Sustainability consciousness (SC) is the state of having enough knowledge or experience to support one's views, attitudes, and behaviours. Sustainability consciousness expands upon environmental awareness, integrating social and economic dimensions into a holistic framework. While environmental consciousness focuses solely on environmental aspects, sustainability consciousness encompasses knowingness, attitudes, and behaviours across all three pillars of sustainability – society, economy, and environment [8, 9, 18, 19]. Knowingness involves understanding the fundamentals of sustainability across these dimensions, which guides attitudes that either favour or oppose sustainable practices. However, attitudes alone don't guarantee behaviour, as behaviour is shaped by a complex interplay of knowledge, attitude, and additional influences like values, norms, and a sense of responsibility toward present and future generations [22]. Sustainability behaviour encompasses actions aimed at supporting environmental, societal, and economic well-being, reflecting values and a commitment to the welfare of all living beings. As touching sustainability in the building construction sector, the Building Technology Education students are supposedly being trained to be pivotal in the stride [8, 10, 15, 16].

Building Technology Education (BTE) vocational and technical education programme that equips individuals with the essential knowledge and practical skills crucial for designing and constructing homes [13, 20]. Being a vocational programme, it aims to cultivate teachers and construction professionals proficient in applying technology to building design and execution while effectively passing on these skills to learners in diverse educational settings. BTE focuses on producing sub-professionals capable of performing key tasks like production, management, costing, maintenance, and implementation within the realm of building construction [12]. Geared towards employment and entrepreneurial endeavours, BTE imparts trade-specific skills such as Brick/Block Laying, Painting, Draughtsmanship, Tiling, and Plastering, shaping graduates into building

technologists or educators who teach Basic Technology in junior secondary schools or engage in building projects alongside professionals from various disciplines [13, 20]. The BTE programme encourages an understanding of evolving trends like sustainability, urging graduates to integrate environmentally friendly practices into building construction and aligning with sustainable principles in their thinking and actions.

However, a critical gap exists in understanding the current level of sustainability consciousness among students pursuing building technology education. Do these budding teachers and construction technologists possess the requisite knowledge, tools, and mindset to navigate the complex terrain of sustainable construction? Are educational institutions adequately equipping them with an understanding of eco-friendly materials, energy-efficient designs, and innovative technologies that minimize environmental impact? Ascertaining this knowledge gap underscores the urgency to assess the sustainability consciousness of the students, and possibly shed light on the sustainability content of the curriculum within these educational programmes.

In brief, while the clarion call for sustainable practices within the building construction industry grows louder, the pivotal role of building technology education students remains under scrutiny. Bridging the gap in their sustainability consciousness stands as a crucial milestone in steering the industry towards a greener and more responsible future. The journey towards sustainability demands a collaborative effort, with educational institutions playing a pivotal role in nurturing a cohort of professionals equipped not just with technical prowess but also with a profound commitment to environmental stewardship.

1.1. Research Question

This study explores the question: What is the sustainability consciousness level of building technology education students?

1.2. Hypothesis

The students will be compared based on their level of study. The null hypothesis states that: there is no significant difference in the sustainability consciousness level of building technology education students in the final year and other years.

2. Methodology

This study adopted a descriptive survey design, which sought to ascertain responses from Building Technology Education Students using a questionnaire as an instrument. Descriptive surveys are ideal for exploring and describing characteristics, attitudes, and behaviours within a specific population [14]. In this case, the aim was to understand the behaviours, attitudes, and knowledge levels of BTE students toward sustainability.

The population for the study was 171 Building Technology

Education (BTE) students from 11 Nigerian universities. We employed convenience sampling, especially in institutions where the students were reportedly on industrial training or semester break, during the data collection period. Data collection methods included both online submissions via Google Forms and physical administration, where students were asked to complete the questionnaire and return it directly to their instructors during practical classes. The data collection spanned 4 months, resulting in 162 returned/submitted instruments; 5 incomplete copies were discarded, leaving 147 (86%) valid for analysis. The study mainly involved other years (300 level and 200 level in one instance) and final-year BTE students. Due to mixed responses among some direct entry students in their third year, the level of study data was initially disregarded in some versions of the articles emanating from this study. But, the level of study demographic variable was further screened afterward, and every non-final year student was classified as "other years" while those in the final year were designated as "final year". This classification is vital in aiding comparison based on mean statistics.

This study utilized the Sustainability Consciousness Questionnaire (SCQ) as the tool for gathering data. The SCQ serves as a comprehensive instrument that assesses sustainability consciousness (SC) through three components: knowingness, attitudes, and behaviour, each measuring different facets of sustainability. There are both long and short versions of SCQ,

with 50 and 27 items respectively. The short version of SCQ, abbreviated as SCQ-S was used, as it has been reported to have the same outcome with the long version. The instrument consists 27-item scale entirely adopted from the work of Gericke et al. [8], maintaining the same number of items. Participants were instructed to indicate their level of agreement or disagreement with items related to sustainability consciousness using a five-point Likert scale, where 1 indicated "strongly disagree," and 5 denoted "strongly agree." Mean scores from various categories and subscales provided an overview of sustainability in terms of knowingness, attitude, and behaviour. The reliability of the instrument was established using 22 Building Technology Education students of the Department of Vocational and Technical Education, Benue State University, Makurdi, North Central region of Nigeria. The responses to the questionnaire were collated and analyzed using Cronbach alpha and a reliability coefficient (α) of 0.841 was obtained.

Data collected were analyzed using Mean and t-tests of Statistical Package for Social Sciences (SPSS) version 26.

3. Results

Results from the analysis of the sustainability consciousness of BTE students are presented according to the clusters of knowingness, attitude, and behaviour.

Table 1. Mean and Standard Deviation of the Sustainability Knowingness of Building Technology Education Students.

Item code	Sustainability Knowingness	Mean	SD	Remark
SK1	Reducing water consumption is necessary for sustainable development	3.99	0.73	Agreed
SK2	Preserving the variety of living creatures is necessary for sustainable development (preserving biological diversity)	3.64	0.83	Agreed
SK3	For sustainable development, people need to be educated in how to protect themselves against natural disasters	3.65	0.84	Agreed
SK4	A culture where conflicts are resolved peacefully through discussion is necessary for sustainable development.	3.63	0.87	Agreed
SK5	Respecting human rights is necessary for sustainable development.	3.69	0.88	Agreed
SK6	To achieve sustainable development, all the people in the world must have access to good education	3.61	0.86	Agreed
SK7	Sustainable development requires that companies act responsibly towards their employees, customers and suppliers.	3.56	0.84	Agreed
SK8	Sustainable development requires a fair distribution of goods and services among people in the world.	3.70	0.92	Agreed
SK9	Wiping out poverty in the world is necessary for sustainable development.	3.64	0.84	Agreed
SKnow_T	Sustainability Knowingness Cluster	3.68	0.60	Agreed

Table 2. Mean and Standard Deviation of the Sustainability Attitude of Building Technology Education Students.

Item Code	Sustainability Attitudes	Mean	SD	Remark
SATT1	I think that using more natural resources than we need does <i>not</i> threaten the health and well - being of people in the future.	3.86	0.83	Agreed
SATT2	I think that we need stricter laws and regulations to protect the environment.	3.87	0.94	Agreed
SATT3	I think that it is important to take measures against problems which have to do with climate change.	3.91	0.78	Agreed
SATT4	I think that everyone ought to be given the opportunity to acquire the knowledge, values and skills that are necessary to live sustainably	3.88	0.75	Agreed
SATT5	I think that we who are living now should make sure that people in the future enjoy the same quality of life as we do today	4.15	0.79	Strongly Agreed
SATT6	I think that women and men throughout the world must be given the same opportunities for education and employment.	4.11	0.70	Strongly Agreed
SATT7	I think that companies have a responsibility to reduce the use of packaging and disposable articles.	4.20	0.73	Strongly Agreed
SATT8	I think it is important to reduce poverty.	4.12	0.72	Strongly Agreed
SATT9	I think that companies in rich countries should give employees in poor nations the same conditions as in rich countries.	4.15	0.77	Strongly Agreed
SAtt_T	Sustainability Attitude Cluster	4.06	0.66	Strongly Agreed

Table 1 presents the outcomes regarding the students' awareness of sustainability, specifically focusing on their sustainability knowingness. The respondents displayed agreement across all nine items within the sustainability knowingness cluster of the SCQ. This agreement signifies a notable level of knowledge and awareness among the students regarding sustainability-related matters. The collective responses within the sustainability knowingness cluster strongly suggest a generally high level of understanding and awareness among the respondents concerning sustainability issues.

In Table 2, the survey responses concerning the students'

sustainability attitude are shown. Across all nine items within the sustainability attitude cluster of the SCQ, the respondents showcased agreement. This collective agreement suggests a strong inclination among the students to partake in actions aligned with sustainability principles. This inclination further reinforces the earlier observed presence of knowledge and awareness regarding sustainability issues among the respondents. The overall coherence in the sustainability attitude cluster highlights a prevailing consensus in the students' attitude dispositions toward sustainability, indicating a shared inclination or readiness to engage in behaviours that promote sustainability.

Table 3. Mean and Standard Deviation of the Sustainability Behaviour of Building Technology Education Students.

Item Code	Sustainability Behaviour	Mean	SD	Remark
SB1	I recycle as much as I can.	4.10	0.70	Strong Agreed
SB2	I always separate food waste before putting out the rubbish when I have the chance.	4.07	0.73	Strong Agreed
SB3	I have changed my personal lifestyle in order to reduce waste (e.g., throwing away less food or not wasting materials).	4.07	0.76	Strong Agreed
SB4	When I use a computer or mobile to chat, to text, to play games, and so on, I always treat others as respectfully as I would in real life.	3.87	0.82	Agreed
SB5	I support and aid organizations or environmental groups.	3.84	0.88	Agreed
SB6	I show the same respect to men and women, boys and girls.	3.89	0.78	Agreed
SB7	I do things which help poor people.	3.88	0.74	Agreed
SB8	I often purchase second - hand goods over the internet or in a shop	3.91	0.72	Agreed
SB9	I avoid buying goods from companies with a bad reputation for looking after their employees and the environment.	3.82	0.80	Agreed
SBehav_T	Sustainability Behaviour Cluster	3.96	0.56	Agreed

Table 3 shows the data regarding the respondents' agreement with sustainability behaviours. Across all 9 items within the sustainability behaviour cluster of the SCQ, the respondents indicated agreement. This alignment suggests that the students are actively demonstrating behaviours that support sustainability initiatives. The collective agreement

within the sustainability behaviour cluster also signifies a consensus among the respondents regarding the actions or tendencies required to advance sustainability objectives. These findings imply that the students are inclined toward and actively participating in actions that contribute positively to the sustainability agenda.

Table 4. T-test Analysis of Sustainability Consciousness of Building Technology Education Students Based on Cluster Mean Values.

Variables	Level	N	Mean	Std. Dev	t-cal	Df	Sig.	Remark
SKnow_T	Other Years	76	3.78	0.71	-.244	145	0.03	S
	Final Year	71	3.57	0.45				
SAtt_T	Other Years	76	4.28	0.46	-.294	145	0.00	S
	Final Year	71	3.82	0.75				
SBehav_T	Other Years	76	4.08	0.52	.314	145	0.01	S
	Final Year	71	3.83	0.58				
SC_T	Other Years	76	3.87	0.39	-.004	145	0.00	S
	Final Year	71	3.66	0.43				

Note: SC_T = sustainability consciousness of the total population

Table 4 outlines the results of a *t*-test analysis comparing the various constructs and the overall sustainability consciousness among Building Technology Education (BTE) students in their final year against those in other years. The *t*-cal values were found to be significant at a 0.05 level of significance. Using the total sustainability consciousness (SC_T) of the students as a base, Table 4 reveals that *t*-cal (2,145) = -0.004; *p* < .05. The *t*-cal of -.004 with a *p*-value of 0.00 calculated at .05 level of significance, and at 145 degrees of freedom is less than 0.05.

Thus, the null hypothesis that there is no significant

difference in the sustainability consciousness level of Building Technology Education students in the final year and other years, was not upheld. There is therefore significant difference in the sustainability consciousness of BTE students based on their levels of study. This outcome suggests a noteworthy dissimilarity in sustainability consciousness among BTE students based on their academic progression, emphasizing a significant divergence in sustainability awareness and engagement between final-year students and their counterparts in other years of study.

4. Discussion

Tables 1 to 4 collectively offer a comprehensive insight into the sustainability consciousness of Building Technology Education (BTE) students, covering their knowingness, attitudes, behaviours, and differences across academic years.

Table 1, focusing on sustainability knowingness, reveals a unanimous agreement among respondents across all nine items. This alignment underscores an appreciable base of knowledge, awareness, and experience of sustainability issues among BTE students. It indicates a foundational knowledge base concerning sustainability concepts, reflecting positively on their educational background and preparation in this domain. Moving to Table 2, which assesses sustainability attitudes, a similar trend emerges. The students exhibit consensus across all attitude-related items, indicating a strong inclination or intention to engage in actions aligned with sustainability principles. This highlights not just knowledge but also a positive disposition and readiness to actively participate in sustainability initiatives. More so, in Table 3, focusing on sustainability behaviours, the respondents showcase agreement across the behavior-related items, suggesting active involvement in actions supportive of sustainability. This reinforces the notion that the students aren't just knowledgeable and inclined but are also actively participating in behaviours that contribute positively to sustainability. These findings are in line with the studies of: [8-11, 17].

Gericke and colleagues [8] emphasized the significance of sustainability consciousness, highlighting its broader scope compared to mere environmental awareness. They underscored its encompassing nature, addressing not just environmental concerns but also societal and economic aspects. Their work highlighted that when a group of individuals demonstrates sustainability consciousness, it indicates a sufficient understanding and alignment with beliefs, emotions, and actions supportive of sustainability principles. This underscores the crucial role of sustainability consciousness among Building Technology Education (BTE) students in preparing them for the challenges and opportunities within the construction industry.

Recognizing this importance, it's vital to emphasize and enhance the sustainability consciousness of BTE students. Incorporating coursework focused on green building materials, energy-efficient design, and sustainable construction techniques, as advocated by Omeje et al. [21], emerges as a crucial strategy. By integrating these topics into the curriculum, educational institutions can effectively nurture and elevate the level of sustainability consciousness among BTE students. This approach not only equips future professionals with the necessary knowledge but also instills the attitudes and behaviors essential for promoting sustainable practices within the building construction industry.

Furthermore, Table 4 in this study introduces an additional layer by comparing sustainability consciousness among students in their final year versus other academic years.

Despite a minute calculated difference (t -calculated of -0.004), the statistical significance reveals a meaningful disparity in sustainability consciousness between these groups. This suggests that final-year students have a distinctive level of sustainability awareness compared to their counterparts in earlier academic years. Corroborating this finding is the study by Berglund et al. [11], who found that differences exist in the sustainability consciousness of students across two cultural contexts. Hence, variations are evident in the students' understanding of sustainability, their attitudes, and behaviors. It's essential to create opportunities for thorough investigation through inquiry-based studies and evaluations of sustainability concerns at different stages throughout the Building Technology Education (BTE) students' academic progression.

However, contrasting research outcomes have emerged concerning students' awareness and consciousness regarding sustainability. For instance, Kalsoom et al. [17] discovered that pre-service teachers in Pakistan exhibited low sustainability consciousness, suggesting their unpreparedness to address sustainability topics in educational or professional settings post-graduation. Similarly, Alsaati et al. [9] observed a lack of sustainability awareness among a group of university students, indicating their unfamiliarity with sustainability-aligned actions like recycling, utilizing renewable materials, and conserving resources such as light and water. Overall, the findings of this study collectively paint a picture of BTE students possessing not only knowledge but also positive attitudes and behaviours aligned with sustainability. Additionally, the differences identified across academic years emphasize the evolving nature of sustainability consciousness throughout the students' educational journey. These insights are invaluable for educators, institutions, and policymakers, indicating the need for continuous reinforcement of sustainability education and practices throughout the BTE curriculum to foster a more comprehensive and consistent sustainability consciousness among these future professionals in the construction industry.

5. Conclusion

The findings from the assessment of Building Technology Education (BTE) students' sustainability consciousness are encouraging and insightful. Across knowingness, attitudes, and behaviours related to sustainability, students demonstrated alignment and agreement, indicating not only a robust understanding of sustainability concepts but also a positive inclination and active engagement in behaviours supporting sustainability initiatives. Moreover, comparing academic years revealed a significant difference in sustainability consciousness between final-year students and those in earlier academic stages. This highlights the evolving nature of sustainability awareness throughout the educational journey, suggesting that as a student progresses, sustainability consciousness becomes more pronounced.

These findings underscore the effectiveness of BTE programmes in instilling sustainability knowledge and

fostering positive attitudes and behaviours among students. However, they also emphasize the need for continuous reinforcement of sustainability education throughout the curriculum. By recognizing these differences across academic levels, educators and policymakers can tailor interventions to ensure a consistent and progressive approach to sustainability education, equipping future professionals in the construction industry with the necessary knowledge, attitudes, and behaviours to drive meaningful and lasting sustainability practices.

Conflicts of Interest

The authors declare no conflicts of interest.

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