

Greening TVET: Advancing Sustainability Across the Construction Curriculum at a TVET College in Jamaica

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ABSTRACT: This case study explores the integration of environmental sustainability—“greening”—within the construction curriculum at a Technical and Vocational Education and Training (TVET) college in Jamaica. Guided by UNESCO’s Education for Sustainable Development and the ILO’s green skills agenda, the study investigates how graduates understand, implement, and apply greening. Graduates were surveyed, and focus groups were conducted with students and instructors. Findings reveal that greening is conceptualized as resource conservation, recycling, and environmentally responsible practices. Integration occurs through project-based learning, including solar panel installation, rainwater harvesting, and the reuse of scrap materials. Graduates reported awareness and preparedness regarding the use of eco-friendly materials and the consideration of the environmental impact of materials used at work. Barriers include limited employer understanding, cost constraints, and inconsistent workplace emphasis. The study underscores TVET’s role in advancing sustainability and recommends strengthening instructor training, embedding greening across curricula, and fostering industry partnerships.

KEYWORDS: greening TVET, environmental sustainability, construction curriculum, green skills, Education for Sustainable Development (ESD)

I. INTRODUCTION

There has been growing concern with strengthening environmental sustainability globally (Akinyele et al., 2025; International Labour Organization, 2022; United Nations Educational, Scientific, and Cultural Organisation [UNESCO], 2022; Yang et al., 2025). Jamaica has embraced this as an essential national imperative and is implementing strategies in line with this global agenda. As a country, Jamaica has integrated the Sustainable Development Goals (SDGs) into its Vision 2030 plan (Planning Institute of Jamaica [PIOJ], 2009). Additionally, the Jamaican government has recognized the need to address environmental stewardship as a key strategic focus while advancing economic growth (Jamaica Information Service [JIS], 2024). According to the JIS (2024), Jamaica is focusing on uniting economic expansion with stringent environmental regulations. The Jamaica Environment Trust (JET), a government agency focused on environmental issues, advocates for environmental conservation through biodiversity preservation and the prevention of wasteful practices.

To strengthen its focus, the government of Jamaica has collaborated with international organizations, such as the United Nations Environment Programme [UNEP], to implement environmental sustainability initiatives (UNEP, 2019). According to UNEP (2025), the need for environmental sustainability is driven by tourism, high petrol and petrol supplies expenditure, and impacts on local production and consumption. Goal #4 in Jamaica’s Vision 2030 national goals and outcomes addresses a healthy natural environment. This will lead to outcomes such as sustainable management of environmental resources, hazard risk reduction, adaptation to climate change, and sustainable urban and rural development (PIOJ, 2009). Recognizing sustainability as an imperative for national development in Jamaica, UNEP noted that Jamaica is striving to transition to a more efficient, socially inclusive, and green economy through initiatives such as Jamaica Vision 2030 and the Caribbean Green Economy Project (UNEP, 2019).

1.1 Environmental Sustainability and Education

Environmental sustainability in education has become a central focus of global development, with UNESCO’s Education for Sustainable Development (ESD) agenda highlighting the need for transformative learning that addresses ecological, social, and economic challenges (UNESCO, n.d.). In Jamaica, this global priority is reflected in efforts to align educational reforms with national sustainability objectives, particularly through curriculum innovation and institutional collaboration (Ministry of Education, Youth, and Information, 2016; Roofe Bowen & Bramwell, 2020; Planning Institute of Jamaica [PIOJ], 2009).

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In describing environmental education in the Caribbean, Ferguson (2008) stated that efforts have been made to integrate it into schools at all levels. Ferguson (2008) further describes the scope of environmental education as extending to the curriculum, teaching materials, and teachers' professional development. She calls for further studies to examine the effects of environmental education on other aspects of the curriculum. In the Jamaican context, Ferguson (2014) emphasized the importance of embedding environmental consciousness within educational institutions to foster awareness and proactive behaviour among youth. Roofe Bowen and Bramwell (2020) support this focus and further argued for the integration of ESD within national education reform, including curriculum development, with the aim of nurturing environmentally responsible citizens. To support Jamaica's focus on environmental sustainability, ESD is integrated into the Jamaica National Standards Curriculum. It is also reflected in the instructional strategies and the use of information and communication technology (Bramwell-Lalor et al., 2024).

However, Roofe and Ferguson's (2018) analysis of lower-secondary TVET curricula revealed that while ESD perspectives are present in some areas, substantial gaps remain. Many ESD-related issues and skills are only partially integrated or absent, with misalignment among curriculum objectives, content, teaching strategies, and assessment. This underscores the need for a more comprehensive approach to integrating ESD in education to ensure meaningful sustainability outcomes. TVET, like general education, needs to be concerned with environmental sustainability and how it is integrated into the curriculum so that students are equipped with the knowledge, skills, and attitudes to contribute to it in homes, communities, and workplaces.

The reorientation of curricula, teaching, and learning in TVET to equip future generations with the competencies needed to shape understanding and decision-making for a sustainable future is referred to as Greening the TVET Curriculum. It is a process that entails aligning training practices and institutional operations with sustainability goals, ensuring that programs prepare learners with the knowledge, skills, and values necessary to work in sustainable industries (Greening Responses to Excellence through Thematic Actions [GRETA], 2023).

1.2 Purpose of the Study

This case study explores the extent to which students and instructors at a construction college in Jamaica understand and embrace greening, and how these skills are being transferred by students who have completed the construction program and are now employed. The following research questions guided the study.

1. How do instructors and students understand the concept of Greening?
2. In what ways is the Greening approach being integrated into the construction curriculum?
3. To what extent are construction students who are now employed applying Greening strategies at their place of employment?
4. What obstacles do graduates face in applying Green practices in their work?

1.3 Conceptual Framework

To equip institutions with practical guidance to integrate greening into their TVET systems, UNESCO–UNEVOC developed a greening guide. The objective of the guide, as described by UNESCO – UNEVOC, is to 'equip teachers and educators with up-to-date knowledge on environmental issues, green technologies, and sustainable curricula and training methods (UNESCO – UNEVOC, 2017). The Greening Guide outlines five approaches for integrating greening into TVET institutions to support sustainable development. They are:

1. Greening the campus
2. Greening the curriculum and training
3. Greening research
4. Greening the community and workplace
5. Greening the institutional culture

UNESCO-UNEVOC's Greening Guide recommends integrating greening principles into the curriculum, teacher professional development, institutional facilities, and instructional methodologies. These key areas are detailed in Figure 1.

Figure 1. Approaches for integrating Greening in the TVET curriculum

Greening the Campus	This extends to a broad range of physical features, operating goals, and methods. It is applied to institutional structures, philosophies, and services. It aims to reduce costs associated with resource usage. It also aims to make the campus more accessible to students with disabilities.
Greening the Curriculum and Training	This aims to address what is taught to students in an institution-based and work-based setting. This includes relevant content aligned to job tasks in the workplace. The contents include the knowledge, skills, and attitudes that will enable students to function well in a green economy. This extends to environment-related content and green skills.

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Greening Research	The greening research addresses how best to improve greening in the institutional culture. It includes operations, products, student and trainee outcomes. It also looks at applied research that generates practical solutions to problems. Research will enable sustainability plans to be driven by research data.
Greening the Community and Workplace	The greening of workplaces extends to how TVET institutions can influence workplace greening. This includes promoting practices that reduce the environmental impact of business operations.
Greening Institutional Culture	This includes setting the tone and the expectation that will be an important part of the institutional culture. This should be reflected in the institution's day-to-day practices and underpin its values and ethics.

(UNESCO-UNEVOC, 2017, pp 36 -40)

The ILO (2022) has also recognized the importance of integrating greening in TVET and has developed a tool to operationalize this focus in the curriculum. The tool represents a systematic process for integrating greening into the curriculum. The key steps in the process are:

1. Developing competency standards that outline skills for green jobs
2. Greening the curriculum by integrating the competency standards
3. Integrating greening in training at the level of the provider
4. Greening assessment
5. Greening the TVET campus
6. Integrating greening in the professional development of teachers and trainers
7. Sensitizing enterprises to the need to green TVET
8. Integrating greening in the informal economy
9. Integrating greening into TVET systems

II. LITERATURE REVIEW

2.1 TVET and Sustainable

TVET, in addition to its focus on social and economic development, is also concerned with its role in relation to environmental sustainability— an important aspect of transformative TVET (Majumdar, 2009; Chola & Kiplagat, 2025; Mustapha, 2015). Societal and technological advancements, coupled with growing concerns about climate change, environmental degradation, and resource scarcity, are reshaping the nature of work. These challenges affect individuals, communities, and societies (UNESCO, n.d). The need for TVET to equip individuals with the skills and knowledge required to support the transition to a green economy and sustainable societies is widely recognized (UNESCO, 2017; ILO, 2019).

TVET, therefore, contributes to the Sustainable Development Goals by equipping graduates with skills for national development (Asukwo, 2020; UNESCO, 2016). The sustainable development focus of TVET in Jamaica aligns with UNESCO's Sustainable Development Goal #4, which is 'to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all by 2030' (UNESCO, 2024).

In this context, TVET is viewed as having not only economic and social rationales but also an environmental agenda, thereby emphasizing its important role in environmental sustainability (Marope et al., 2015). According to Marope et al. (2015) and Fien and Wilson (2005), the environmental sustainability rationale is also aligned with the economic and social equity rationale. The implication is that it recognizes the importance of economic pursuits, but not at the expense of the environment and ecosystems.

Recognizing the importance of TVET's contribution to environmental sustainability, UNESCO (2017), ILO (2022), and Cedefop (2012) have argued for integrating environmental sustainability into workforce training and highlighted the critical role of the labour market. They have also developed resources for integrating greening into technical and vocational education and training systems and curricula (UNESCO, 2017; ILO, 2022). Additionally, the UNESCO TVET strategy 2024 underscores the importance of responding to emerging demands of the green economy. Member States have been sensitized to these resources and how to use them effectively through workshops and webinars. At the 3rd International TVET Conference in Shanghai (2012), a special initiative titled "Greening TVET: Qualification Needs and Implementation Strategies" was introduced to support green Technical and Vocational Education and Training (TVET).

2.2 National Service and Training Agency (NSTA) and Environmental Sustainability

The HEART NSTA Trust, the major provider of technical vocational education in Jamaica, aligns its strategic direction with Jamaica's social and economic priorities (HEART/NSTA Trust, 2024), which is consistent with the philosophy of TVET (Fien et al., 2005; Marope et al., 2015; MacLean, 2005; Mu'azu, 2021). The mandate of the Trust is to "provide vocational, lifelong

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learning and employability skills that will propel the economy towards productivity and higher value-added activities in critical sectors" (HEART/NSTA Trust, 2024, p.4).

The integration of environmental sustainability, an imperative of the Jamaican government, is therefore aligned with the strategic direction and programme offerings at the HEART NSTA Trust. This focus is reflected in the Trust's strategic plan (HEART/NSTA Trust, 2024) and in its environmental policy, which seeks to integrate environmentally friendly practices into policies and programmes to sustain the environment. The objectives of the policy extend to promoting and increasing awareness of sustainable environmental practices and supporting environmental programmes and practices aimed at reducing costs. The organization is focusing on greening for the years 2025 to 2029 as reflected in its strategic direction (HEART/NSTA Trust, 2024). In December 2024, an assessment was conducted to determine the extent to which greening strategies were being sufficiently integrated in five workforce colleges. The report concluded that there was room for further development and integration of greening practices in areas of operation (HEART NSTA Trust, 2025).

The focus on developing green skills is integrated into the curriculum areas of Construction, Hospitality, Automotive, Agriculture, Beauty and Wellness, and Information and Communication Technology. The integration of greening competencies aligns with international standards and reinforces commitment to implementing an environmental, social, and governance framework that establishes systems and processes to manage impact, address risks, and seize opportunities (HEART NSTA Trust, 2023).

2.3 Greening

The focus on greening is an important aspect of environmental sustainability within the context of TVET (Marope et al, 2015; Fien & Wilson, 2005; UNESCO, 2024). Recognizing the urgency of environmental challenges, members of the UNEVOC network designated "greening TVET" as a priority theme in 2012, and the UNESCO–UNEVOC Medium Term Strategy IV describes the importance of strengthening greening in TVET within the context of skills for inclusive and sustainable economies (UNESCO, 2024).

Greening, according to UNESCO–UNEVOC (2017, p.7), is defined as “the process of pursuing knowledge and practices with the intention of becoming more environmentally friendly and enhancing decision making and lifestyle in a more ecologically responsible manner, that can lead to environmental protection and sustainability of natural resources for current and future generations.” The International Labour Organization (ILO) has also addressed the issue of greening. According to the ILO (2022), a green economy is characterised by low carbon, resource efficiency, and social inclusion. In a green economy, investment in growth allows for reductions in carbon emissions and pollution, the efficient use of energy and resources, and the prevention of biodiversity loss and ecosystem degradation (UNEP, 2019). The focus of greening, therefore, is to protect the environment by promoting efficient resource use, safeguarding biodiversity, and preserving ecosystems to ensure resources are available for future generations.

There are many arguments for why TVET needs to focus on greening. In developing sustainable societies, students need to develop skills such as recycling waste, reducing energy use, and protecting the environment from pollution. These skills extend to developing environmentally conscious policies and programmes, conserving water, managing assets, low-carbon construction, eco-tourism, and land management, among others (International Labour Organization, 2022). According to Cedefop (2012), green skills are the knowledge, skills, values, and attitudes needed for life that help reduce the impact of human activity on the environment. McLean and Fien (2010) describe these skills as important for developing values and attitudes, as students have the opportunity to reflect on lifestyle choices and shape their own values. They promote critical thinking and practical skills (ILO, 2016; Pavlova, 2018) and support the development of key employability skills, including cognitive, interpersonal, and intrapersonal competencies. The acquisition of these skills will prepare graduates for jobs that are referred to as green jobs (International Labour Organization, 2022).

According to ILO (2016, p.280), “Green jobs are decent jobs that contribute to preserving or restoring the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency. Green jobs help to improve efficiency in the use of energy and raw materials, limit greenhouse gas emissions, minimize waste and pollution, protect and restore ecosystems, and support adaptation to the effects of climate change.” In advancing the green agenda, Pavlova (2018) emphasizes the need to build partnerships among TVET providers, industry, government, and other stakeholders. Both the UNESCO–UNEVOC guide and the ILO tool emphasize the importance of greening in the training delivery system. By integrating these skills into the culture, ethos, institutional practices, and curriculum, the student will be equipped to demonstrate them in the world of work.

In response to these emerging trends, the NSTA has introduced specialized training initiatives to equip individuals with the competencies required for evolving job opportunities in the sustainable construction sector. It was further recommended that, to advance the green agenda, key stakeholders in the construction industry be actively engaged to facilitate the seamless integration of green skills into TVET curricula and training programs. This collaborative approach ensures alignment with industry needs and supports the transition toward sustainable construction practices (HEART NSTA Trust, 2017).

2.4 Greening the Construction Curriculum

Greening the construction curriculum at HEART/NSTA Trust involves the integration of modules on:

1. Sustainable building design
2. Environmentally friendly construction materials
3. Energy efficiency technologies
4. Waste minimization and recycling strategies
5. Renewable energy integration (e.g., solar photovoltaic systems)

Although public documentation of these modules is limited, the Green Economy Scoping Study (UNEP, 2016) and HEART's institutional mandate support the need for these competencies. Roofe Bowen and Bramwell (2020) argue that TVET reform in Jamaica must embed sustainability not only in course content but also in teaching methods and institutional practices. The HEART/NSTA Trust has made progress by incorporating green building modules, such as solar energy systems, rainwater harvesting, sustainable agriculture, and climate-resilient construction, into its practical training. However, the alignment between curriculum objectives, instructional strategies, and assessment remains inconsistent. The effectiveness of these initiatives is also contingent on robust teacher training, which remains an area for improvement.

III. METHODOLOGY

3.1 Research Design

A Descriptive Case Study design was used. Case study research enables the exploration and understanding of complex issues and is considered a robust research method, particularly when a holistic, in-depth investigation is required (Zaidah, 2007). Descriptive case studies “attempt to present a complete description of a phenomenon within its context” (Hancock & Algozzine, 2011, p. 37), with no attempt or presupposition to generalize to other situations.

3.2 The Case

The HEART College of Construction Services offers both full-time, part-time, and short courses in the construction sector in Jamaica. It also offers assessment services for selected programs. Programs offered at the institution include Carpentry, Civil Construction, Construction Inspection, Masonry, Plumbing, Electrical Maintenance, and Welding. The focus on greening is integrated into the various components of the curriculum. This is done through appropriate learning methodologies and projects that align with the cognitive (knowledge), affective (attitudes and values), and psychomotor (skills) domains.

3.3 Data Collection and Analysis

Permission to conduct the research was received from the Principal of the HEART College of Construction Services. The researchers then worked with the College's Career Counselor to contact the participants. Participants included students who graduated from the construction programme the previous year, current students in the construction programme, and five instructors at the institution.

Surveys were sent to program graduates, and 100 responded. The survey consisted of 23 Likert-type questions, and participants' responses ranged from Strongly Agree to Strongly Disagree. In the survey, graduates were asked whether they were willing to participate in a focus group. Ten graduates indicated their willingness to participate in the focus group session. Ten current students were also chosen, representing various skill areas in the construction industry. The teachers participating in the focus group session were selected from various skill areas within the Construction programme.

Data from the surveys were analysed using descriptive statistics. The focus group session was recorded and transcribed. Transcribed data were then coded, and related thoughts were grouped into categories (Varpio et al., 2017; Lincoln & Guba, 1985). Similar categories were then arranged under a common theme related to the research questions.

IV. RESULTS

4.1 Research Question 1: How do instructors and students understand the concept of Greening?

During the focus group, newer students in the construction program indicated that they understood greening to include reducing, reusing, and recycling materials that can be harmful to the environment to create useful products, such as tables.

It has to do with the environment, by recycling things that we probably would have thrown away, we start finding use for them. So, we are not over—taking too much from the earth, so we are leaving the trees in the woods. Instead of throwing away small pieces of wood, we find use for it instead of chopping down a new tree. Reduce, reuse, and recycle.

Well, in use of pipes, when they are cut. You know, persons, with intent to throw it away. But there can be uses—it can be used to even create, like some table or bypass system, or something, well, to do with gardening also.

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In furniture making, they always tell you measure two times and then cut once. That helped to reduce waste, because if you make fewer mistakes when you measure to make sure you have it right. Small pieces of wood are then reused to make other things.

... for us who are trainees, the small pieces of wood that come from bigger furniture. We use them to train on the machine, ... we use small pieces to train how to use the machine properly.

Students who complete the construction program and are employed explain their understanding of the concept.

It is a way of doing things and protecting the environment. Not having the sewage going into the river. Not having AC for the entire day. Natural breeze coming into the building.

Conservation of energy. Disposal of waste....

It shows concern for the environment. It is 'livity' (life). Plastic bottles impact our 'livity'. Contaminate the environment. It will affect us. It will affect our kids and grandkids...

4.2 Research Question 2: In what ways is the Greening approach being integrated into the construction curriculum?

During the focus group, instructors refer to projects that include solar panels, recycling, and the use of wood scraps to make products such as plant pot frames (See Figure 2).

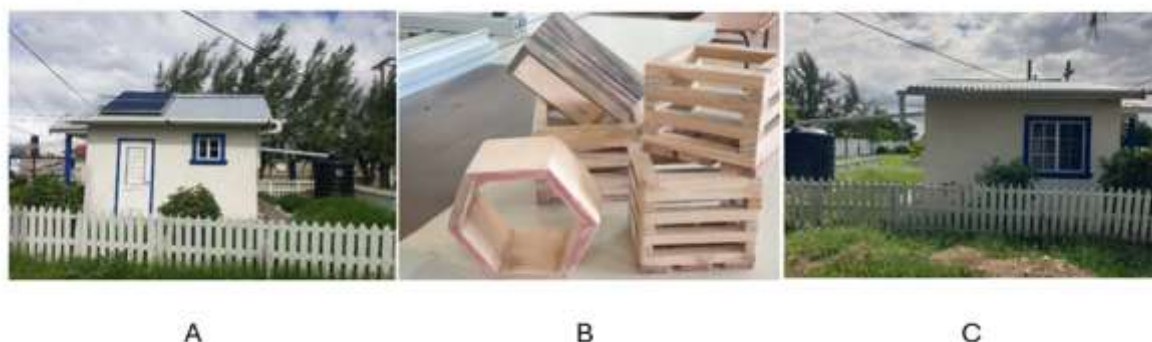


Figure 2. Integrated greening activity in the curriculum: A. Solar panel, B. Plant Potholder, C. Rainwater Recycle

Students referenced projects that required them to apply greening principles. They spoke about using recycled wood to make products and using wood shavings as bedding for animals. They also demonstrated awareness of the dangers posed by chemically treated wood and of restrictions on the use of shavings or dust from these materials.

We do different kinds of joints. We do lap joints, mortise-and-tenon joints, and things like that. We use the small pieces of wood, ...to make them. Not only that, nothing really goes to waste, because even the shavings it is sold to make bedding for chicken and animal places.

Okay, the material in furniture making, there are a lot of manmade boards, and these manmade from scraps of wood abroad. That's why they call them manmade. It is like shavings of board. But the thing is, the chemical is toxic. Those chemicals are toxic. So, when you cut the manmade board on the machine, you cannot use the dust from it in your animal enclosure.

... next thing that we do with scraps we make template, like we are going to make a particular piece of furniture, and we are going to need to cut a whole lot of the same size.

Some students indicated that instructors emphasize Greening sufficiently in the curriculum, while others indicated it could be emphasized more.

For me, I think it could be a little bit more, you know, strengthened,

Well, to me our instructor brings it in a lot, because economizing is the best thing.

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These are made from scrap material. So, you see how small it is, but it is still useful. We are really using up all our scraps, I would say we use up all our scraps. Yes, it is emphasized.

The survey results indicated that 92% of the graduates agreed that the programme had prepared them well for their current jobs (Figure 3). In addition, 89% agreed that they are aware of the greening practices that should be applied on the job.

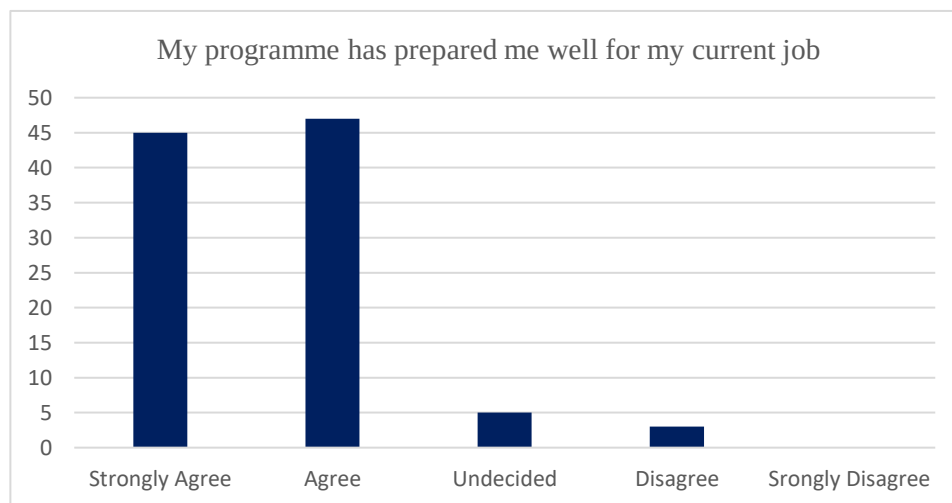


Figure 3. Belief that the curriculum prepared them for their job

4.3 Research Question 3: To what extent are construction students applying Greening strategies at their place of employment?

In the survey, 76% indicated that they use building materials at work that reduce the negative environmental impact (Figure 4). This was supported by 94% who indicated they think about how their actions at work will affect the environment. Additionally, 91% said their actions at work help to reduce negative environmental impacts (Figure 5).

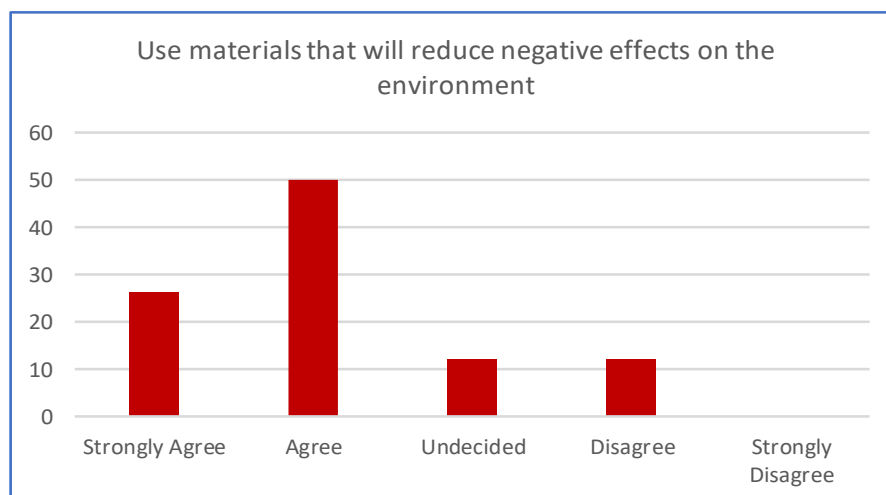


Figure 4 Using materials that will reduce the adverse effect on the environment.

However, 65% indicated that when materials are ordered at work, they may not consider their environmental impact. 64% indicated that the equipment and tools used helped reduce waste. This was somewhat similar to the 69% that said that their supervisor emphasizes the importance of conservation, reducing waste, and recycling (Figure 6).

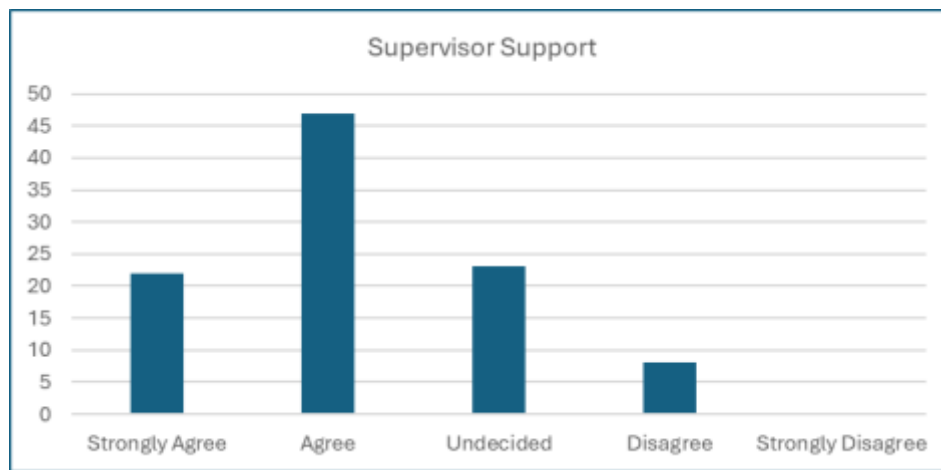


Figure 5. *The supervisor emphasizes the importance of conservation, reducing waste, and recycling.*

Strategies such as disposing of waste in appropriate containers are followed on the job. One graduate refers to his experience working at a national utility company. He stated that at his company, treatment plants were upgraded to be more environmentally friendly, and LED lighting was used in offices to lower energy use and reduce utility costs. He further stated that solar panels are used to heat water. Another graduate speaks to his experience in plumbing, where waste goes to a central storage system.

4.4 What obstacles do graduates face in applying Green practices in their work?

Some graduates felt that some employers lack a strong understanding of greening and are therefore unable to apply it to their job; they are more focused on getting the work done.

They (employers) do not have much understanding. They are not applying it. The focus is on getting the work done.

Often, the ability to implement greening initiatives is constrained by cost. The need for greening strategies is often explained to the customers, but due to the cost, they may forgo the work.

The Parish Councils should get involved before buildings are approved. It is top down... the Client has been introduced to greening principles. Based on the cost, they refused to go with it.

They stretch out the material and compromise safety... They do it differently. It is affected by funding limitations. I will explain the pros and cons (of greening). He (the client) walks away and gets someone else to do the job.

While some participants believed the opportunity to apply greening is often constrained by cost and employers not having a proper understanding of the importance of greening, the majority disagreed that there are more important things to focus on in their work than being concerned about the environment and greening.

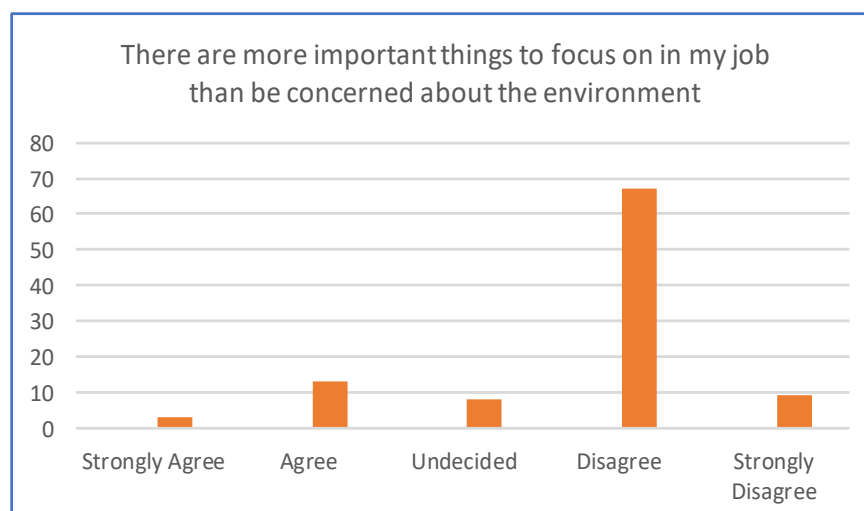


Figure 6: *Participants' perception of whether greening should be given less focus*

V. DISCUSSION AND CONCLUSION

Jamaica is partnering with other countries to advance its Sustainable Development Goals, and there is a deliberate effort to advance education for sustainable development. This case study demonstrates that these efforts have extended to the integration of greening practices for sustainable development in the TVET system. The findings are discussed.

There is a proper understanding and appreciation of the integration of greening in the curriculum among the students and graduates of the TVET College. According to students, Greening should be seen as both a lifestyle and an environmental responsibility, echoing Ferguson's (2014) call to embed environmental consciousness in education. Students emphasized reducing, reusing, and recycling materials, aligning with UNESCO–UNEVOC's definition of greening as fostering environmentally responsible knowledge, skills, and values (UNESCO–UNEVOC, 2017). Both instructors and students conceptualize greening as practices of resource conservation, recycling, and waste minimization. Instructors further framed greening as an instructional strategy, emphasizing resource economization, consistent with Roofe Bowen & Bramwell's (2020) argument for integrating ESD into curriculum reform. They reinforced this understanding by embedding greening principles into projects such as solar panel installations and rainwater harvesting, consistent with the ILO's (2022) emphasis on integrating green competencies into training. This shared understanding aligns with global frameworks for greening, but the greening activities remain primarily practical/project-based, suggesting the need for stronger theoretical grounding (Roofe & Ferguson, 2018).

Greening is integrated through hands-on projects and modules that emphasize sustainable construction practices. Examples include recycled-wood furniture, solar panels, and rainwater harvesting, which reflect UNEVOC's (2017) recommendation to embed sustainability into curriculum and training. Survey data indicated that most graduates (92%) felt well-prepared for their jobs, and 89% acknowledged awareness of greening practices. However, some students noted inconsistent emphasis, reflecting broader challenges identified by Roofe & Ferguson (2018), where curriculum objectives, teaching strategies, and assessments are not always fully aligned with sustainability goals.

Graduates reported applying greening strategies at work, particularly in material use, energy conservation, and waste disposal. The majority indicated using environmentally friendly building materials, considering and taking action to reduce environmental impacts. This is consistent with the expectations of green jobs, that is, jobs that minimize waste and pollution while protecting ecosystems (ILO, 2016). These findings suggest that the curriculum is successfully instilling transferable green competencies, which will likely strengthen partnerships between companies and the institution, as companies are confident in the construction curricula. Pavlova (2018) emphasizes the importance of partnerships between TVET and industry in advancing sustainability. However, gaps remain in organizational practices, as procurement and equipment use often fail to prioritize environmental impact (HEART, 2025).

Graduates face challenges, including institutional barriers such as limited supervisor support (only 69% emphasized conservation and recycling); operational constraints, such as procurement decisions that rarely consider environmental impact; and resource limitations, including tools and equipment that are not always optimized for waste reduction. These echo concerns that institutional culture and practice do not reinforce greening, the need for greening practices at the provider and enterprise level, and the observation that systemic economic practices often undermine sustainability (UNEVOC, 2017; UNEP, 2019; ILO, 2022). The findings also highlight the importance of the workplace environment and the key role of managers and supervisors in facilitating the transfer of training (Ratcliff Daffron, Moore, & Chicovsky, 2015; Ng, 2013; Ng & Ahm, 2011).

5.1 Conclusion

This case study demonstrates that greening is being integrated and applied meaningfully in the curriculum of the HEART College of Construction Services, but challenges remain in scaling its impact. Students and instructors share a practical, resource-focused view of greening, emphasizing recycling, conservation, and environmental responsibility. The curriculum incorporates greening through projects and modules, though consistency and depth of emphasis vary. Graduates actively apply greening strategies in their workplaces, showing strong transfer of skills from training to employment. However, the obstacles faced include systemic workplace practices, limited emphasis from supervisors, and resource constraints that hinder the full realization of greening principles.

Overall, the study underscores the importance of aligning curriculum, instructional strategies, and workplace practices to maximize the impact of greening in TVET. This will clearly necessitate strengthening instructor training, embedding sustainability more comprehensively across curricula, and fostering stronger industry partnerships. The findings have implications for the HEART NSTA Trust. These include revising curricula to consistently embed sustainability across all modules, expanding instructor training on green technologies and sustainable construction, and greening the campus itself to model sustainability practices. Establish monitoring systems to track the integration of greening and its outcomes.

Implications for instructors include balancing practical projects with deeper theoretical discussions on sustainability; using project-based learning linked to community initiatives; using innovative assessments to measure sustainability competencies; and implementing cross-disciplinary project activities. For industry stakeholders, implications include aligning workplace procurement and equipment use with sustainability standards and training supervisors to reinforce conservation and recycling

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practices. Partnering with TVET institutions to co-design curricula reflecting industry needs and advocating for government incentives for companies adopting green practices.

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