Received 20 August 2022
Revised 16 October 2022
21 November 2022
Accepted 25 December 2022

Appraisal of students' perceptions on green building concepts in a technical university

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Abstract

Purpose – The main goal of this study was to determine how students at Ho Technical University (HTU) viewed green construction approaches and the benefits green buildings may provide to Ghana's tertiary institutions to enhance quality of life.

Design/methodology/approach – The institution's 350 participants were chosen using a random selection method. A standardised questionnaire was used to gather data, which was analysed using SPSS v.20 and presented in tables using descriptive statistics such as Likert scale analysis, weighted mean and relative importance index (RII).

Findings – The study revealed that awareness of the green building principle is comparatively low amongst the survey participants. Participants agree that the University's green building adoption is high. Students cited decreased utility expenses, improved occupant productivity and cheaper operational costs as important benefits of green construction. Students' thoughts on hurdles to implementing green construction ideas at the University were the enormous price tag of green building technology (RII = 0.89), ignorance of demonstration projects and ignorance of information on green building principles (RII = 0.81).

Originality/value – This is one of the first papers to study Ghanaian students' views on green buildings. This study adds to our understanding of students' thoughts on green building ideas. In addition, it sheds insight into their present awareness, which can help the university administration in Ghana design new paths for green building implementation.

Keywords Green building, Ho Technical University, Students, Adoption, Benefits and barriers

Paper type Research paper

1. Introduction

1.1 The green building concept (GBC) and certifications

The advent of the 21st century ushered in an era of green design and construction (Yudelson, 2007; Howe, 2011). This era resulted from a growing awareness of how structures use

The authors appreciate the help of the research assistants who gathered data and the study's participants who graciously answered the survey questions.

Funding: The authors received no direct funding for this research.

Competing interests: The authors declare no competing interests.

Data availability statement: The data that support the findings of this study are available from the corresponding author upon a reasonable request.

resources, impact people and degrade the environment (Bauer *et al.*, 2009). The understanding that the world has little time to respond to mounting threats and hazards of climate change, particularly global warming; and that buildings play a significant role in minimising carbon emissions that drive global climate change propel this movement even more (Yudelson, 2010; Kibert, 2016).

Humans design and develop buildings to meet social demands for housing, economic investment and cooperation (Anzagira *et al.*, 2019). The building industry consumes 38% of global energy, making it a major energy consumer emitter of green-house gasses (GHG) (Laeeq *et al.*, 2017). As a result, there was a greater desire to reduce the environmental impact of buildings, which led to a greater awareness of the need to modify our traditional approach to building design, operation and maintenance (Anzagira *et al.*, 2021). This desire and determination have led to the global appeal of the GBC (Laeeq *et al.*, 2017; Anzagira *et al.*, 2019).

The words "sustainable construction" and "green building" are substitutable and stem from the notion of sustainable development. Green building is "the practice of creating environmentally responsible and resource-efficient structures and processes throughout a building's life-cycle, from siting to design, construction, operation, maintenance, renovation and deconstruction" (Hopkins, 2016). The GBC represents our collective sustainability in the face of environmental degradation and climate change (Oluwunmi *et al.*, 2019). Green construction reduces the impact of buildings and development on human health and the environment. "Green building" is a construction industry response to encourage sustainable demand on finite natural resources such as water, electricity and other natural resources to provide better wellbeing and eco-friendly qualities (Oluwunmi *et al.*, 2019).

Though there are no uniform performance targets for green buildings, numerous countries have developed criteria and standards for measuring green building performance. Two of these standard certifications are the British Research Establishment Environmental Assessment Method (BREEAM) and the American Leadership in Energy and Environmental Buildings (LEED). A building is considered "green" if it meets approved green rating system benchmarks, as defined by the Building Environment Assessment Methods (BEAM) standards (Cole, 2005). The idea of a "zero energy building" is based on the concept that buildings can be powered by energy sources other than fossil fuels, like the sun, wind and geothermal channels, to promote energy sustainability inside structures. Green building elements such as energy efficiency, indoor air quality, resources and water conservation are condensed in BREEAM and LEED (Oluwunmi *et al.*, 2019).

1.2 Green university campus

Green campuses promote environmental awareness and action via education (Fachrudin *et al.*, 2020). University campuses are communities that teach, conduct research and house students. So, University campuses have urban features and different types of buildings, and green University campuses will lead to green urban construction in Ghana, which is dealing with the environmental and energy burdens of growing urbanisation (Chankseliani and McCowan, 2021; Liu and Wang, 2022).

A green campus is where ecologically conscious practice and education coexist and where environmentally-conscious beliefs are shown by action (Muthu and Edwin, 2020). Zhang *et al.* (2011) noted that universities or higher education institutions (HEIs) could be regarded as mini cities or even small municipalities as a result of their size, population, infrastructure and complexities of activities. According to Yeh (2006), for a university to be referred to as a "green university", the said university must implement sustainability regulations in the management and general operation of the institution and its educational procedures, including curriculum development.

The health and wellbeing of the student according to Kimani and Kiaritha (2019) are impacted by social and economic issues. Better daytime lighting and indoor air quality provided by green buildings contribute to a decrease in student illness and absenteeism. Green building features, like views of lush plants outside, make it easier to learn and concentrate. Students benefit from green buildings because they use innovations to control ventilation, pollution prevention and moisture. In a school setting, improved indoor environmental quality (IEQ) leads to increased teacher and student productivity (Ackley *et al.*, 2017). Furthermore, adopting green concepts can serve as a focus for later studies by staff and students for research purposes, leading to new perspectives and knowledge development on the GBCs, consequently positively impacting the overall image of the university.

1.3 Benefits and barriers to adopting green building concepts

In Ghana, the uptake of GBCs is slow due to embedded impediments (Anzagira *et al.*, 2019), despite its numerous benefits. Although there is a slight premium for building greenhouses, the long-term benefits always outweigh the additional capital costs (Rosenkranz, 2022). Green buildings have been shown to improve human health and community well-being by increasing environmental quality, lowering energy and water usage and enhancing life-cycle economic performance (Ramesh and Emran, 2013). According to research by Ashuri and Durmus-Pedini (2010), green buildings emit fewer carbon emissions, have greater tenant satisfaction, consume less energy and water and consequently have lower overall maintenance costs. In addition, because of the green features and services built into it, a green building helps reduce operational expenses such as electricity and water. Another notable feature of a green building is the healthy atmosphere such as the indoor air quality it creates throughout its lifespan (Kimani and Kiaritha, 2019). Green buildings are concerned with providing comfort for humans, safety, productivity and extending the lifespan of natural resources; hence, they are constructed for occupant comfort, resource efficiency, environmental responsibility and people's wellness (Tathagat and Dod, 2015; Al horr *et al.*, 2016; Bestbier, 2019).

It is critical to first understand and solve the barriers to green building technology (GBT) adoption to promote GBT adoption effectively and efficiently (Mao *et al.*, 2015). Prior research has revealed that barriers to adopting GBTs and practices exist in developed and developing nations (Chan *et al.*, 2018). According to Hopkins (2016), lack of awareness, championing of sustainable development policy and financial concerns are some of the main barriers to the adoption of campus green building principles. Debrah *et al.* (2020) published the findings of a quantitative assessment of the impediments to green city development in developing nations: evidence from Ghana. The research recognised a lack of understanding of a green city's benefits, environmental degradation and insufficient policy implementation efforts as severe impediments to green city development in Ghana. Kanyaura and Obino (2015) and Agyekum *et al.* (2020) found that the key obstacles were expert knowledge gaps, lack of acceptable regulatory framework, capital expenditure, lack of incentives, initial capital cost, split incentives and risk-related barriers. They also found significant differences in professionals' views regarding green building project financing. According to Chan *et al.* (2017), resistance to change, high GBT prices, inadequate information and awareness, poor competence and inadequate government incentives were identified as the most significant impediments to GBT adoption in the United States. Comparable research revealed that capacity barriers, cultural and social resistance, lack of incentives for promotion, inadequate cost data, a limited range of green products and materials, delays in obtaining permits and certification and inadequate information about the financial, economic benefits and opportunities, deficiencies in the legal framework, lack of clear Russian standards and defined certification criteria, taking into account the specificity of the Russian market, lack of principles of strategic planning in the sphere of the urban environment are some of the main barriers to green development in South Africa and Russia (Simpeh and Smallwood, 2015, 2018; Yakubov, 2018). Finally, Wu *et al.* (2019) and Darko *et al.* (2020) also discovered that higher costs of GBT, lack of government incentives, lack of financing schemes (e.g. bank loans), unavailability of GBT suppliers, absence of local institutes and facilities for GBT research and development, lack of policy and industry guidance, immature market environment and the lack of environmental awareness are the main impediments to GBTs adoption in Ghana and China, respectively.

Current research demonstrates a deficit in green building principles in educational institutions for developing nations, particularly Ghana. As a result, this study investigates students' views on the adoption of green buildings in a Ghanaian Technical University, utilising HTU as a case study. Thus, our research would add to existing knowledge by categorising the benefits of green construction, which can help bring green buildings into the mainstream and highlight the huge contribution tertiary institutions in Ghana stand to gain by adopting the GBC. As a university with a major focus on technology and applied sciences that provides more opportunities for students to better understand technological developments, the research seeks to assess students' views on adopting more GBCs on their campus.

2. Research methodology

The primary goal of this study was to determine how students at HTU viewed green construction approaches. The study used a quantitative method, and a questionnaire was used because it gives a complete and objective view of a subject. The study's design allowed the researchers to collect empirical data to answer research questions or evaluate the study's goal.

2.1 Study setting

This study was carried out at Ho Technical University (HTU). HTU, as displayed in Figure 1 was established in 1968 as a technical institute with the primary objective of providing pre-technical education but has over the years evolved into a polytechnic (1986) and currently a technical university (2016). The institution is mandated to award degrees to the highest level including diplomas, certificates and other qualifications in engineering, science and technology-based disciplines, technical and vocational education and training, applied arts

Figure 1. View of Ho Technical University (HTU campus)

and related disciplines. Despite its tertiary nature and apart from the tertiary level courses that it handles, the university has maintained its TVET character. HTU comprises five faculties and two schools, namely, the Graduate School, HTU Business School, Faculty of Engineering, Faculty of Built and Natural Environment, Faculty of Applied Social Sciences, Faculty of Applied Sciences and Technology and Faculty of Art and Design.

The study's target group was HTU students from all academic programmes who had been at the University for one year or longer at the time of the survey. When giving the surveys, respondents were chosen using a random selection procedure from levels 100 to 400. This method was used to guarantee that at least students from all academic departments were adequately represented and included in the study, avoiding the prejudice typically associated with other sampling methods.

2.2 Sample size analysis

The sample size for the population was calculated using the normal approximation to the hyper-geometric distribution formula, as shown in equation (1) (Dzah *et al.*, 2022).

$$n = \frac{NZ^2pq}{\left(E^2(N-1)+Z^2pq\right)} \tag{1}$$

where,

pq = estimated percentage of success and failure considered to be 50% as there was no previous study at the time of this study, N = population size of students from level 100 to 400 = 4,000, E = margin of error = 3% and Z = standard score value for 95% confidence level = 1.96. The minimal sample size (n) was 350.

2.3 Data collection and instrument design

Three hundred and fifty respondents participated in this research survey, which was conducted between October and December 2021. The responses to the questionnaire were checked for errors, inconsistencies and contradictions. The data were processed using the Statistical Package for Social Sciences (SPSS) version 20 to process the obtained data, which included questionnaires, identification numbers and replies. The data were analysed and displayed in tables using descriptive statistics such as Likert Scale analysis, weighted mean and relative importance index (RII). In agreement with Debrah *et al.* (2020), the variable with the highest mean is rated higher in cases when two or more variables have the same RII.

The questionnaire was divided into five sections and was mostly closed-ended. The first section of the questionnaire asked for basic biographical data such as gender, age, level and programme at the university. The second section looked at knowledge of green building principles using a five-point Likert scale to gauge perceptions (5 = excellent; 4 = very good; 3 = good; 2 = fair and 1 = poor). The third, fourth and fifth sections examined the embrace of green building principles, the benefits of adoption of green principles in buildings and barriers to adopting green principles in buildings, using a five-point Likert scale to gauge perceptions (5 = extremely significant; 4 = very significant; 3 = moderately significant; 2 = slightly significant and 1 = not significant). The degree of green building standards implementation was measured using variables that followed the *BREEAM* and *LEED* recommendations (Oluwunmi *et al.*, 2019).

3. Results

The validity and reliability of the questionnaire are studied further (Bolarinwa, 2015). Validity refers to the degree to which a question examines the element it is meant to test.

It will be helpful in various studies and research if the questionnaire is statistically reliable and valid. In SPSS, Cronbach's alpha may be used to assess dependability. The alpha value of 0.70 is a standard measure for measuring reliability (Taber, 2018). The overall Cronbach's alpha for this study's responses was 0.912, which is greater than the suggested threshold of 0.7, suggesting an outstanding evaluation of the test items' reliability and consistency.

The questions answered by the participants in the questionnaire and their results are presented in Table 1.

3.1 Bio-data of respondents

Table 2 shows the gender, age and educational background of the respondents. In the study, 69.1% of the respondents were male and the rest (30.9%) were female. In addition, 54.7%, 35.4%, 6.0% and 1.1% of the subjects were >25, 26–34, 35–44 and 44–54 years old, respectively. The study further revealed that 4.3% were at level 100 while 39.1% were at level 200. Exactly 44% were at level 300, whereas only 12.6% were at level 400. Figure 2 shows that students from various programmes at the institution were fairly represented in the survey.

Test item	Coefficient alpha	Sub-values
Level of adoption of green building principles	0.730	5
Benefits of adoption of green principles in buildings	0.879	12
Barriers to adopting green principles in buildings	0.719	12
Overall Cronbach's alpha value	*0.912*	*29*

Source(s): Cronbach's alpha test run

Table 1. Test results for validity and reliability

Gender		Age (Yrs)		Class (Level)	
Male	69.1%	*> 25*	57.4%	*100*	11.5%
Female	30.9%	*26–34*	35.4%	*200*	15.0%
		35–44	6.0%	*300*	69.0%
		44–54	1.1%	*400*	4.5%

Source(s): Fieldwork (2021)

Table 2. Demographic characteristics of respondents

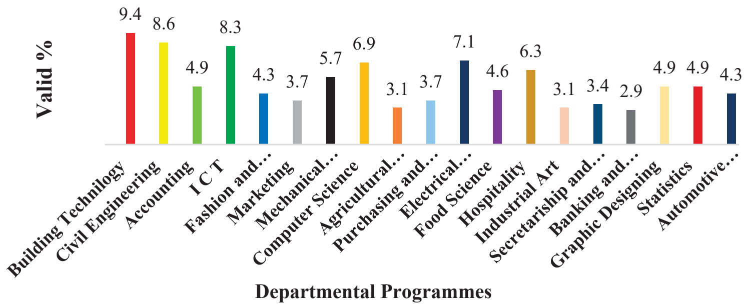

Figure 2. The programme offered by respondents

3.2 Knowledge of green building principles

The students were asked to rate their understanding of GBCs and practices. Their replies are shown in Table 3.

$$\textbf{Mean Response (M.R)} = \frac{(5\times 11)+(4\times 15)+(3\times 104)+(2\times 139)+(1\times 81)}{350}$$
$$= \mathbf{2.25}$$

Since the computed mean response is less than the critical region value of 3, the null hypothesis may be accepted with the result that awareness of the green building principle is comparatively low amongst participants of this survey. The survey's findings indicate that while a sizable portion of the sample population has heard of sustainable building practices, only a few comprehend them.

3.3 Level of adoption of green building principles

On a five-point Likert scale, the students were asked to rate the level of adoption to which the University has adopted green construction standards. The variables were chosen based on the BREEAM and LEED guidelines. Their replies are shown in Table 4.

From the results shown in Table 3, the students strongly agree that indoor air quality within Ho Technical University is healthy and comfortable for students and staff [(mean = 3.87), (RII = 0.77)]. Further results revealed that water resources, including surface and groundwater, are adequately preserved, controlled and developed at Ho Technical University with a score of [(mean = 3.85); (RII = 0.77)]. Again, the students perceived that valuable resources including trees, minerals, animals, water and others are responsibly exploited and safeguarded in the university scoring [(mean = 3.78); (RII = 0.76)].

3.4 Benefits of adoption of green principles in buildings

This part examines the benefits of green construction as seen by the students. Table 5 depicts students' perceptions of the benefits of incorporating green standards into the university's structures. The data were analysed using the five-point Likert scale.

From the students' viewpoints on the benefits of using green construction concepts, the five critical improvements identified in the investigation with the highest ranking were: lower utility cost of building, improving occupants' productivity, reducing operational costs, improving quality of life (QoL) and protecting students' health and comfort with mean scores of [(mean = 4.08), (mean = 4.05), (mean = 3.92) and (mean = 3.87)]. However, they are

Code	Category	No. of respondents
1	Poor	81
2	Fair	139
3	Good	104
4	Very good	15
5	Excellent	11

Note(s): Using the Likert scale analysis as a statistical tool, let
H_0 = knowledge of the green building principle is low
H_1 = knowledge of the green building principle is high
Coding in SPSS; Excellent = 5; Very good = 4; Good = 3; Fair = 2 and Poor = 1
Critical region = 3; accept the null hypothesis if the mean response is less than 3 and reject if it is greater than 3
Source(s): Fieldwork (2021)

Table 3. Knowledge of green building principles

Building principles	5	4	3	2	1	MN	RII	RNK
Indoor Air Quality (IAQ)–The indoor air quality at Ho Technical University is safe and comfortable for students and employees	109	125	79	35	2	3.87	0.77	1
Water conservation – Ho Technical University's water resources, including surface and groundwater, are adequately preserved, controlled and developed	107	126	79	35	3	3.85	0.77	2
Resource conservation – At Ho Technical University, valuable resources including trees, minerals, animals, water and others are responsibly exploited and safeguarded	85	145	80	37	3	3.78	0.76	3
Livable communities – The neighbourhood of Ho Technical University is safe and secure, with reasonable and appropriate housing and transportation options, as well as consistent community amenities and services	86	132	92	40	0	3.75	0.75	4
Energy efficiency – Ho Technical University saves energy by using a compact fluorescent lamp instead of a standard incandescent bulb, and by strategically placing windows to improve airflow	86	129	90	45	0	3.73	0.75	5

Table 4. Level of adoption of the university's embrace of green building principles

Benefits of adoption	5	4	3	2	1	MN	RII	RNK
Lower utility cost of building	91	210	36	13	0	4.08	0.82	1
Improve occupants productivity	90	191	64	5	0	4.05	0.81	2
Reduce operation cost	109	126	91	23	0	3.92	0.78	3
Protect students' health and comfort	117	108	91	31	3	3.87	0.77	4
Improve the quality of life	108	126	79	35	1	3.87	0.77	5
Establish a benchmark for future design and construction	85	147	78	38	2	3.79	0.76	6
Protect biodiversity and ecosystems	86	132	92	40	0	3.75	0.75	7
Improve indoor air and water quality	97	108	106	38	1	3.75	0.75	8
Reduction in pollution and environmental degradation	98	115	96	30	11	3.74	0.75	9
Energy efficiency and water conservation	91	123	87	49	0	3.73	0.75	10
Minimise strain on local infrastructure	86	129	90	45	0	3.73	0.75	10
Facilitate a culture of best practice sharing	32	120	104	34	0	3.77	0.58	12

Table 5. Benefits of adopting green principles in buildings

sceptical that green development can reduce pollution and environmental degradation and provide energy efficiency and water conservation while also setting a benchmark for minimising strain on local infrastructure.

3.5 Barriers to adopting green principles in buildings

Finally, students' opinions on the barriers to the university's adoption of green principles were solicited. Understanding the roadblocks to effective green initiative creation can assist in the identification of solutions to promote sustainability in the built environment. Understanding the hurdles that exist from the students' perspective is critical to proposing practical answers and recommendations to alleviate such barriers, accelerate the expansion of green buildings throughout tertiary institutions in the country and accelerate the development of a sustainable building sector. Table 6 depicts the students' viewpoints. The data were also analysed using the five- point Likert scale.

Table 6.
Students' opinions on the barriers to the university's adoption of green principles

Barriers of adoption	5	4	3	2	1	MN	RII	RNK
Enormous price tag of green building technology	169	170	9	2	0	4.45	0.89	1
Ignorance on information on green building principles	90	209	38	13	0	4.07	0.81	2
Ignorance on demonstration projects	92	190	63	5	0	4.05	0.81	3
Various parties' competing interests in adopting green building (conflict of interest)	114	149	62	25	0	4.01	0.80	4
Lack of understanding of the necessity of green construction concepts by management of universities	110	145	78	17	0	3.99	0.80	5
Risk and uncertainty involved in adopting green building principles	109	125	93	23	0	3.91	0.78	6
Green technology in building is time-consuming	117	111	89	30	3	3.88	0.78	7
Resistance to change from the use of traditional principles/absence of interest	109	125	79	35	2	3.87	0.77	8
Complex and strict requirements involved in adopting green standards in building	85	145	80	37	3	3.78	0.76	9
Government indifference to the promotion of green building concepts	90	122	103	35	0	3.76	0.75	10
Ignorance on expert knowledge and mastery on green buildings	86	132	92	40	0	3.75	0.75	11
Ignorance on green building principles and merits	86	129	90	45	0	3.73	0.75	12

According to respondents, the enormous price tag of GBT ranked first with an RII of 0.89. In addition, ignorance of demonstration projects and ignorance of information on green building principles ranked second with an RII of 0.81, conflicts of interests amongst various stakeholders in adopting green building, and ignorance of the importance attached to green building principles by university management ranked fourth with an RII of 0.80.

4. Discussions of results

4.1 Summary of findings

In accordance with the findings of this study, participants' awareness of the green construction principle is quite low. This is to be expected, given that they are students from a range of fields, as seen in Figure 1. Comparable research done by Zaki *et al.* (2016) and Hopkins (2016) demonstrates that while many people in the sample population have heard of sustainable building, only a small number comprehend the ideas. Anzagira *et al.* (2019) confirmed that GBCs are being implemented at a relatively modest pace in underdeveloped nations like Ghana, compared to their counterparts in affluent countries. This is as a result of the public's apparent ignorance of green building standards thus limiting their horizon (Addy *et al.*, 2020). Therefore, individual knowledge of green building issues is crucial to its success. Since it is well-established that raising public knowledge of an issue or policy usually results in more significant public backing, raising public awareness of green construction practices should have a similarly beneficial effect (Hopkins, 2016; Anzagira *et al.*, 2021).

For the adoption of green building principles, the students strongly agree that the indoor air quality within HTU is healthy and comfortable for students and staff. The results agree with Ackley *et al.* (2017), and further affirm the status of the capital city of the Volta Region (Ho), Ghana, as the "Oxygen city" in Ghana because of its lush greenery, clean air and general emphasis on healthy and clean sanitary conditions (GNA, 2021). It is common knowledge that the environment significantly affects our well-being. Occupants of green buildings have reported significant improvements in their health, stress levels and QoL due to upgraded air quality (Al horr *et al.*, 2016). Further results revealed that water resources, including surface and groundwater, are adequately preserved, controlled and developed at HTU. Water efficiency is another concrete benefit of green architecture. Specialised water purification systems enable water recycling and alternative water sources. These enhancements protect this natural resource and future clean water supplies (Bestbier, 2019). Students' opinions on Covenant University's use of green concepts in a building were disclosed in a similar study by Oluwunmi in 2019. Students unanimously believe that the institution is safe and secure, provides inexpensive and appropriate housing and transportation options and provides consistent community features and services (Oluwunmi *et al.*, 2019).

Unfortunately, energy efficiency was not critically accessed by the students. Energy efficiency is a fundamental priority in green building design. Creating structures that get their energy from natural sources like the sun, wind, and water is beneficial to the environment since it protects the ecosystem from pollution caused by non-renewable sources. Srinivas (2009) discovered that green construction may greatly help to reduce potable water use between 30 and 40% and power consumption between 20 and 40%. Since higher education institutions are being forced by the sustainable development goals (SDGs) to adapt to deal with a world in crisis (Žalėnienė and Pereira, 2021), energy-efficient university campuses will be critical in the creation of future sustainable cities and in meeting the SDGs in Ghana. Therefore, in developing nations like Ghana where per capita energy consumption is rising quickly due to high economic growth, there is a need to combine cutting-edge energy-efficient technologies in buildings of tertiary institutions with the adaptation of vernacular architecture practices, which use more locally accessible materials and resources (Economic Policy Forum, 2014).

The primary benefits identified in the investigation by the students of using green construction concepts were: lower utility cost of building, improved occupants' productivity, reduced operating costs, improved QoL and protection of students' health and comfort. However, the study's participants were sceptical that green development could reduce pollution and environmental degradation, provide energy efficiency and water conservation, and set a benchmark for minimising strain on local infrastructure. According to Oluwunmi *et al.* (2019), the primary benefits from students' perspective of adopting green principles in buildings were: to enhance indoor air and water quality, minimise pollution and environmental degradation, preserve energy and water, safeguard biodiversity and ecosystems and cut building utility costs. These findings indicate that respondents thought buildings should be built with the priority of providing a high-quality interior environment for all inhabitants and users in mind (Tathagat and Dod, 2015). Green buildings offer several economic or financial benefits to various individuals or organisations. Green buildings increase environmental quality, reduce energy and water use and improve life-cycle economic performance, which improves human health and community well-being (Ashuri and Durmus-Pedini, 2010; Ramesh and Emran, 2013). According to Kimani and Kiaritha (2019), green buildings improved lighting and indoor air quality help to reduce student illness and absenteeism. Learning rates and attentiveness are increased by green architectural elements like outdoor vistas of lush greenery. Students benefit from green buildings because they employ advancements in ventilation, pollution reduction, and moisture management. In a school setting, greater IEQ leads to increased teacher and student productivity (Lee *et al.*, 2012; Brink *et al.*, 2020).

Finally, the barriers to implementing green building principles revealed the enormous price tag of GBT, ignorance of demonstration projects and information on green building. In addition, conflicts of interest amongst various stakeholders in adopting green building, and ignorance of the importance of green building principles by the university management were identified. This result confirms the findings of the barriers to implementing green principles provided in the literature by Wu *et al.* (2019) and Darko *et al.* (2020). These results also corroborate the findings of Oluwunmi *et al.* (2019) at Covenant University in Nigeria, where students highlighted challenges to implementing green concepts in the University's buildings. According to the authors, ignorance of green building principles and their benefits, the enormous price tag of GBT, ignorance of expert knowledge and mastery of green building, ignorance of government promotion of green building principles and the importance attached to green building principles by university management were the key barriers identified. Again, expert knowledge gaps, a lack of an acceptable regulatory framework and a lack of understanding of the green idea in other important research contributed to the low rate of adoption of green building technologies, as reported by Kanyaura and Obino (2015). The consensus is that developing green structures costs more, making them a poor choice for approaches to affordable housing programmes. Recent research, however, has shown the opposite. Although building greenhouses does come at a somewhat higher cost, the long-term advantages always outweigh the additional capital expenses (Rosenkranz, 2022).

Since green building is a relatively novel development, stakeholders in the built environment will need to learn new methods to analyse and advocate for its widespread use. Likewise, those invested in the built environment must adjust to new ways of thinking and acting to support green construction initiatives. It is worth stressing that the negative environmental consequences of building development will not be adequately mitigated so long as green building remains a niche sector (Simpeh and Smallwood, 2018).

4.2 Study implications

This study highlighted students' perceptions of the benefits and barriers to the implementation of GBCs in a technical university. This paper is one of the first to have accessed the views of an under-researched group of students at a technical university in Ghana.

Regarding the awareness of GBCs, participants' knowledge of the concept is very limited. The participants were also sceptical that green development could reduce pollution and environmental degradation, provide energy efficiency and water conservation and set a benchmark for minimising strain on local infrastructure. The barriers to implementing green building principles revealed the enormous price tag of GBT as the main hindrance to its implementation.

Although campus green building is a relatively new subject of study, there has been an increasing interest in it. Despite this increased enthusiasm, college green construction requirements face several obstacles. Due to the potential environmental and economic benefits of campus green construction standards, it is necessary to investigate these inefficiencies-causing obstacles. Without significant and far-reaching changes in the academic world through SDGs, Universities are in danger of losing their vital role as centres of research and knowledge. Potential solutions to overcome difficulties that may further boost the adoption of green campus buildings are crucial (Hopkins, 2016).

Applying the notion of green design to campus is an excellent idea (Tamiami *et al.*, 2018). Students respond positively to campus structures and environments. Although not all green design concepts have significant effects on students' QoL, this study found that the few green design concepts implemented on campus may improve students' QoL, making a strong case for the widespread adoption of green buildings and sustainability initiatives on campuses of Ghana tertiary institutions.

Therefore, in support of Kimani and Kiaritha (2019), all tertiary institutions should consider going green in their next constructions or adding green features to the existing buildings. The institutions should find ways of reducing their huge operational costs and also fully utilise renewable energy. Sustainable development should be included as a learning unit in the curriculum to instil a culture of environmental sustainability in the learners.

4.3 Limitations of the study

Despite the study achieving its goals, certain limitations should be noted. The number of samples size was modest. Additional research can be conducted on a large group of people, including the staff of the university. Future research would investigate these problems in other tertiary institutions in Ghana.

5. Conclusion

This research set out to investigate the perceptions of green building principles in a technical university to promote QoL in Ghana. The importance of the stated benefits and challenges has been evaluated from the viewpoint of students from HTU. The study revealed that participants' awareness of green building principles is comparatively low. However, a majority believed that the university's level of adoption of green building principles is high. As a result, a more concerted effort is needed to create awareness, which will speed up the growth, adoption and implementation of green building principles in tertiary institutions across Ghana.

Current research demonstrates a deficit in green building principles in educational institutions for developing nations, particularly Ghana. Green construction should be considered a vital component of sustainable development strategy when addressing university operations and planning. Implementing GBCs and technologies in tertiary institutions would contribute significantly to achieving the SDG's goals in Ghana. Therefore, the findings of this study can be used as a support tool for identifying the most significant benefits that influence stakeholders' decisions to adopt green buildings. In addition to providing continuous improvement that is required for green buildings to gain a competitive advantage over traditional construction methods across tertiary institutions in Ghana.

This study concludes and suggests that, with support from the government of Ghana, tertiary institutions in Ghana should consider becoming green with their planned building projects or putting green features into their current structures to increase the green performance of university buildings to improve the QoL of its users, which includes students and employees. To promote environmental sustainability, the curriculum should include a unit on GBCs. Sustainability principles in academic curricula increase students' knowledge, views, awareness and attitudes about sustainability. Finally, university management teams in Ghana should be educated through forums on the benefits of adopting green building standards to improve their reputations, satisfy education and research demands and improve their financial conditions as a consequence of adopting a more sustainable energy mix and environmental protection ideas.

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