

EVALUATION OF AWARENESS OF STUDENTS IN THE BUILT ENVIRONMENT PROGRAMME ON SUSTAINABILITY IN NIGER STATE

Sustainability is a broad and complex concept, which is one of the major issues confronting construction in the 21st century. Sustainable principles, when applied, lead to the creation of systems that balance social, economic and natural resource requirements of the present and future generation. One of the major hindrances to the development and implementation of sustainability strategies in the construction sector is poor awareness level. Therefore, institutions of higher education are essential stakeholders in fostering understanding and forging a way forward in achieving a sustainable future. Thus, this study seeks to investigate the sustainability awareness and understanding of final year students in construction field at the Universities and Polytechnics located in Niger State, Nigeria. The quantitative technique was employed for this study and questionnaire survey instrument was used for data gathering. A total of two hundred and fifty (250) questionnaires were distributed to respondents from Building Technology, Architecture, Quantity surveying, and a total of one hundred and ninety nine (199) representing 80% were received and analyzed using descriptive and inferential statistical tools. The findings of this study identified twenty sustainability principles applicable to construction project, nine of these principles should be given more attention in construction projects and suggest a higher level of awareness of sustainability principles among students in University than among Polytechnic students. Similarly, the general acceptance on desire to apply and integrate sustainability principles is significantly higher for both 500 level and HND II. However, the findings suggests the inclusion of environment impact assessment, design and sustainable development, the use of the campus as laboratory, and student to attend a conference into curriculum as sustainability courses and modalities for inculcating sustainability idea in students. Regulatory body of higher institutions of learning and practice should ensure that sustainability and its dimensions for competence growth must be included in the curriculum.

CHAPTER ONE

1.0

INTRODUCTION

1.1 Background to the study

After the signing of the Rio Declaration on environment in 1992 during the Earth Summit, the idea of sustainability received a lot of attention. Sustainability is a broad and complex term that has become one of the most pressing concerns of the construction industry. Sustainability is a condition in which the elements and functions of the ecosystem are preserved for the present future generations (ISO 15392; 2008). Sustainability, according to Oscar *et al.* (2009), means improving people's quality of life by allowing them to live in a healthy society with better social, economic, and environmental conditions. The term "sustainability" has been widely discussed as a concept that incorporates all aspects of the economic, environmental, and social worlds. "Development that meets current needs without jeopardizing future generations' ability to meet their own needs" is how the Brundtland Commission described sustainable development (UNGA).

A sustainable project is one that is designed, built, restored, managed, or reused in a way that is environmentally friendly and resource efficient (Oscar *et al.*, 2009). It can, according to the author, achieve a number of specific goals, including resource and energy conservation, reduction of CO₂ and GHG emissions, pollution control, noise prevention, good indoor air quality, and environmental friendliness (Fung *et al.*, 2005). Sustainability is a key concept in development thinking, and the construction industry is at the forefront of making it a reality. The construction industry contributes to environmental destruction in a variety of ways; as a result, the concept of sustainability has been integrated into the

industry in a number of ways. However, simply incorporating the idea of sustainability into the construction industry is insufficient; industry stakeholders must comprehend and bring the concept into practice. One of the most important impediments to the implementation of sustainable building strategies is a lack of awareness. Higher education institutions play a critical role in disseminating information and developing strategies to raise sustainability awareness (Abubakar *et al.*, 2016; Ferrer-Balas, 2008). It is important to revisit the technology education curriculum on a regular basis in order to enhance students' comprehension and incorporate sustainability (Muhammad *et al.*, 2019). According to the author, if sustainability concepts are not included in the offered curriculum, students' perceived competence could suffer. It may also contribute to inefficient energy management, heat pollution, and carbon emissions (Boca and Sarach, 2019). Literatures on sustainability in the construction industry related to Nigeria are minimal (Mayere, 2016). As a result, this research aims to fill a gap in the literature about sustainability courses and modalities that would improve the teaching of sustainability values in higher education institutions. The aim of this study is to look at students' sustainability knowledge and understanding of sustainability in the built environment, as well as sustainability courses and modalities that could be included in the curriculum for teaching sustainability in higher education. The results of this study are extremely important to the current body of knowledge in the field.

1.2 Statement of the Problem

Ecosystems are being severely impacted by the continued growth of industrialisation and urbanisation. People's health, economic, and social well-being are jeopardized when natural

systems are affected, because we rely on the services they provide. Concerns regarding environmental protection and the preservation of biosphere functions have set the stage for deciding how sustainable development can grow. Since the building industry leads to the degradation of the environment in so many respects, the principle of sustainability was introduced into the industry to help minimize depletion. However, simply incorporating sustainability techniques into building is insufficient; practitioners and field staff must understand and put the strategies into effect. Sustainability is now a focus in development thought and the construction industry is leading the charge to make it a reality. One of the major barriers to applying and incorporating sustainability methods in construction is a lack of awareness. A study conducted on students from a university in the south eastern part of Texas in the United States reveal that only a minority of the students knew what sustainability was, but more than half of the students surveyed indicated that there were no courses or programs that focused solely on sustainability issues (Isreal, 2018). Higher education institutions play an important role in teaching sustainability and paving the way for a more sustainable future (Ferrer-Balas, 2008; Abubakar *et al.*2016). Literatures on sustainability in the construction industry related to Nigeria are minimal (Mayere, 2016). This led the researcher to focus his research on students in the built environment who will be responsible for applying sustainable development concepts to construction projects after they graduate. Based on the researcher's initial analysis of relevant literature, it appears that none of the previous studies on sustainability have concentrated on the inclusion of unique sustainability courses and modalities to instil the principle of sustainability in students at Nigerian higher education institutions. As a result, this study aims to close the current gap

by concentrating on final-year students in university and polytechnic built environment programs.

1.3 Justification for the study

Individuals are equipped with the necessary knowledge, skills, values, and attitudes to contribute to sustainable development in order to build a more sustainable environment. Education for Sustainable Development is described as education that enables every human being to gain the knowledge, skills, attitudes, and values required to form a sustainable future. Without education, people would not be able to develop the necessary knowledge, skills, and values to create a healthy society. As a result, education for sustainable development has been identified as a critical tool in raising public awareness and understanding of the issue, and has been emphasized as an effective tool in growing public awareness and understanding of the issue. Higher education institutions will help students become more aware of environmental problems and work for a more sustainable future (Abubakar *et al.*, 2016; Ferrer-Balas, 2008). Students' awareness of sustainability will allow them to consider and contribute to sustainability in the long run. Higher education institutions must integrate sustainability values into their teaching curriculum in order to increase student awareness of sustainability (Stough *et al.*, 2018).

This argument supports Tasneem *et al.* (2020), who argue that one of the measures educational institutes should take to improve sustainability literacy is to make sustainability courses mandatory. As the word "sustainability" becomes more commonly used in business, young graduates' sustainable mindsets must be nurtured (Perez-Foguet *et al.*, 2018). Although attempts have been made to stress the value of sustainability education

(Tejedor *et al.*, 2018), little attention has been paid to investigating the inclusion of sustainability in technology education curriculum for the purpose of enhancing students' competence (Stough *et al.*, 2018). There is an urgent need in the construction industry to address such core long-term competencies among students. As a result, research into sustainability courses and modalities for inclusion in the curriculum of construction-related programs at Universities and Polytechnics is required. This study would examine students' sustainability awareness in construction-related programs, as well as propose sustainability courses and modalities for teaching sustainability in higher education. The study's findings are extremely important to the existing body of knowledge in the field of study. The findings of the study add to the body of knowledge in the field.

1.4 Aim and Objectives

The aim of this research is to assess the awareness of students in built environment programme on sustainability in Niger State with a view to suggesting sustainability courses and modalities for teaching sustainability in curriculum.

The objectives set towards achieving this aim are to:

- i. identify and ascertain the sustainability principles in construction industry.
- ii. determine extent of agreement on awareness and understanding of sustainability principles in construction among students studying in built environment across educational level.
- iii. determine extent of agreement on applicability and desire to integrating sustainability principles to construction projects among students studying in built environment across educational level.

- iv. suggest sustainability courses and modalities needed for promoting sustainability awareness and understanding of stakeholders in construction industry.

1.5 Research Questions

To clearly give direction to this study and achieve its objectives, the following research questions were formulated:

- i. What are the sustainability principles in construction projects?
- ii. To what extent do students agree on awareness and understanding of sustainability principles?
- iii. To what extent do students agree to apply and integrate sustainability principles in construction projects?
- iv. What are the sustainability courses and strategies for integrating sustainability into the curriculum?

1.6 Scope of the Study

This investigation was conducted to assess awareness of student's of built environment programme on sustainability and specific courses and modalities needed to inculcate in students the idea of sustainability in the curriculum of higher institution of learning in Nigeria as perceived by final year students studying Architecture, Quantity Surveying and Building Technology in Federal University of Technology, Minna, and Federal Polytechnic, Bida in Niger State during the 2019-2020 academic year, the aspect looked into covered the sustainability principles in construction industry, awareness and understanding of sustainability principles in construction among students, applicability and

desire to integrating sustainability principles to construction projects among students, sustainability courses and modalities needed for promoting sustainability awareness and understanding of stakeholders in construction industry.

1.7 Limitation to Study

Limitation of the study includes the weaknesses of the study beyond the control of the researcher. The potential drawbacks to this survey research include inflexibility to change phrasing on a particular question seem to be confusing a member of respondents as responses start coming in. At this stage it is too late to change the question for the respondents who have not yet returned their survey. The weakness also spring out of the inaccuracies of the perceptions of the respondents, not all of them could be correct in their assessment. Some could have inaccurate if not entirely wrong perceptions. The survey was based on sample size of 280 students in a University and Polytechnic in Niger State, Nigeria. The analysis of sustainability courses and modalities in curriculum of built environment was limited to materials available to the researcher.

Any limitations must be taken into account. To begin with, this research approach had its own set of limitations. In this study, a quantitative survey was carried out. This study's results might not be as detailed as they should be. Second, a systematic survey of 199 students was conducted on a particular University and Polytechnic in Niger state, Nigeria. The sample size, on the other hand, was a limitation that can be resolved in a future study. Third, the study of education courses and their content is based on what is accessible to readers, which restricts the generalisability of the results. As a consequence, the findings of this study may not be applicable to all Nigerian educational institutions. Future research should try to reproduce these findings in other states and expand the sample size.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

A research project includes a literature review to keep the researcher up to date on previous work on the topic likely to be investigated. As a result, it aids the researcher in identifying gaps in a field (Suresh, 2011), which is accomplished through data collection or analysis of published works. The literature review generates additional questions and themes for the researcher to understand and apply to the research being conducted. Similarly, a content analysis of the literature provides justification for conducting the research (Oliver, 2012). To that end, in order to identify a gap that has not yet been filled, this study has been divided into topics in order to provide broader coverage. This study was designed to provide answers to the questions from the gap identified at the end of the review of literature.

2.2 Understanding of Sustainability in Construction

Sustainability has been extensively discussed as involving economic, environmental, and social aspects. Sustainability is the result of the activities related to the concept of sustainable development (ISO 15392, 2008). This chapter is divided into four sections: the first deals with literature on the word sustainability as it relates to the definition of sustainable development in the construction industry, the second with stakeholder knowledge of sustainability in the industry, the third with stakeholder knowledge of sustainability in the industry, and the fourth with stakeholder knowledge of sustainability in the industry. The final section discusses the sustainability courses and modalities required

to raise sustainability awareness and understanding among students in higher institution of learning.

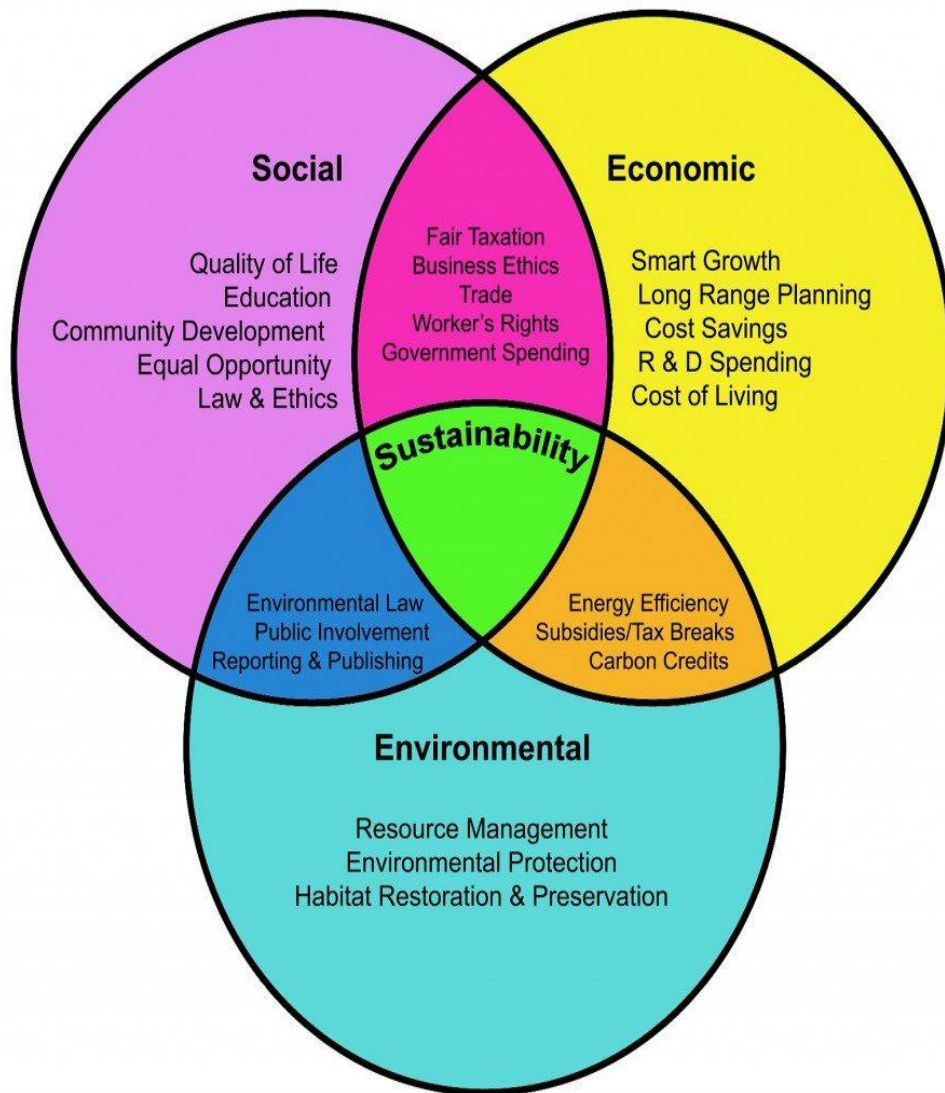


Figure 2.1 Three spheres of sustainability and how they are related.
Source: Journal of Surveying, Construction and Property (JSCP) 2014

Various sustainability principles are used in the construction industry, such as sustainable and green architecture, sustainable and green building, and sustainable and green project management. The terms "green" and "sustainable" were clearly used interchangeably. As a result, various meanings have been assigned to the terms "sustainable" and "sustainable development," the majority of which have been modified to include the three pillars of John Elkington's triple bottom line" concept, which he developed in 1997. (Edward, 1998; Grevelman and Kluiwstra, 2010; Popea *et al.*, 2004). According to Akadiri *et al.* (2012), sustainable building is a system for the construction industry to adopt sustainability while taking environmental, social, and economic factors into consideration. A green building is one that conserves energy, reduces resource depletion, has fewer environmental effects, and protects human health and the environment (Lutzkendoft and Lorenz, 2006; Beatley, 2008).

According to Kibert (2013), sustainable building is the creation and operation of a healthy built environment based on resource efficiency and ecological design, with an emphasis on seven core principles that apply throughout the building life cycle: 1) reducing resource consumption, 2) reusing resources, and 3) utilizing recyclable materials.

2.2.1 Environmental sustainability issues

Many environmental issues have an impact on sustainability. The loss of biodiversity around the world as a result of industrialization and other factors endangering sustainability. Natural ecosystems are frequently destroyed and animals migrate to more suitable areas as a result of deforestation and infrastructure construction. The exploitation of natural resources, as well as the release of pollutants and wastes into the air, water, and soil, puts the future of the earth at risk (Aghbashlo and Rosen, 2018). Air emissions released by internal combustion engines in automobiles, fossil fuel-fired power plants, and

various industrial activities, according to the author, can have a negative effect on air quality and the health of living organisms. Toxic compounds can accumulate in aquatic animal cells, causing eutrophication of water bodies, as a result of industrial liquid pollution, including wastewater, and agricultural runoff.

2.2.2 Economic sustainability

A production system that meets current demand levels without jeopardizing future requirements is an economic component of sustainability (Basiago, 1998). The economic structure is concerned with economic sustainability (Basiago, 1998). Furthermore, enhancing quality of life, economic growth, and the importance of finding a balance between economic growth and environmental conservation are all part of sustainable development (Simion *et al.*, 2013). According to the UN Department of Economic and Social Affairs report, the following are the key principles for achieving economic sustainability: (1) integrating the three pillars of sustainable development (economic growth, social development, and environmental protection) in policymaking and national planning, energy sources such as fossil fuels (crude oil, coal, etc.).

2.2.3 Societal sustainability

Many factors contribute to societal sustainability, including health, equity, cultural development, and many others. The concepts of societal sustainability include social justice, fairness, safety (receive protection in vulnerable situations), sustainable urban form (urban planning/spacing, built environments, land use), and eco-consumption (mode of development and consumption, renewable energy, reuse, recycle) (Basiago, 1998; Eizenberg and Jabareen, 2017). Social capital, social participation, collaborative societies,

and networks, group or cultural stability, basic health and educational needs, and participatory democracy are all aspects of social sustainability (Basiago, 1998; Emas, 2015). These are critical aspects of long-term growth, but they are also related to environmental sustainability. In order to achieve social sustainability, individual autonomy and realization of individual potentials, participatory democracy, fairness, good citizenry and service to others, development of information and resources to help it, protection and security, and a good standard of living, as well as pride or sense of location, must all prevail (Basiago, 1998; Reddy and Thomson, 2015; Emas, 2015; Eizenberg and Jabareen, 2017). There is no consensus about what constitutes social sustainability or what factors contribute to it. It took a long time for sustainability thinking to evolve into one with a strong societal component.

2.3 Sustainability principles identified in the literature

The concepts of sustainability were divided into three categories: environmental, social, and economic. The values were organized into groups based on their importance. As a result of the discrepancies in categorization between published works, other interpretations are possible as shown in the Table 2.1.

Table 2.1 A review of sustainability principles of construction and the authors

	Environmental Principles	Authors
1	Develop on environmentally appropriate area	Mayere (2016), Halliday (2008)
2	Maintain biodiversity and ecology of the site	Mayere (2016), Halliday (2008)
3	Conserve building water and cooling power consumption	Mayere (2016), Ilha <i>et al.</i> (2009), Hill and Bowen (1997), Miyatake (1996)
4	Use energy source with low environmental effects	Mayere (2016), Halliday (2008)
5	Provide clean and healthy environment	Mayere (2016), Halliday (2008)
6	Use products and material than can be recycled or are biodegradable	Mayere (2016)
7	Use materials from recycled sources	Mayere (2016)
8	Use locally manufactured material	Mayere (2016), Halliday (2008)
9	Use durable material	Mayere (2016), Halliday (2008)
10	Implement cost effective measures	Mayere (2016), Hill and Bowen(1997), Kibert (2013)
11	Design to attract investors	Mayere (2016), Hill and Bowen(1997)
13	Design for less material usage	Mayere (2016), Kibert (2013), Cole and Larsson (1999)
14	Whole life value	Mayere (2016), Detr (2000)
15	Use of local construction labour	Mayere (2016), Halliday (2008)
16	Use of local materials suppliers to invest in surrounding community	Mayere (2016) Halliday (2008)
17	Monitoring the integration of the use of space to improve design and reduce in equalities	Mayere (2016), Haberl.(2004)
18	Health assessment of materials and products that can affect workforce safety and health based on life cycle approach	Mayere (2016), Halliday (2008)
19	Minimization of traffic congestion, dust and noise during the construction phase	Mayere (2016), Halliday (2008)
20	Selection of design and construction firms that have a sustainability focus	Mayere (2016), Halliday (2008), Hill and Bowen(1997)

Source: author summary from Literature

2.4 Awareness and understanding the concept of Sustainability

In most research, the importance students place on sustainability during their education is framed as aspirations or interest in sustainability. It is critical to teach students about sustainability and to raise their understanding of the issue. Educational institutions should encourage a long-term approach to technology education in this regard. Universities all over the world are working to improve the sustainability of their programs, science, and curriculum (Huge *et al.*, 2018).

As a result, practices and strategies such as energy efficiency, risk reduction, green computing, sustainable designs, climate change, and resource management must be included in educating students about sustainability (Laurischkat and Jandt, 2018). Integrating sustainability into the curriculum will help students develop their skills (Palacin-Silva *et al.*, 2018). According to the results of a global study of engineering students, despite a lack of general knowledge of sustainability, students were supportive of the concept (Azapagic *et al.*, 2005). Agombar *et al.* (2013) found that most students, regardless of their research backgrounds, considered sustainability to be important to some extent for their studies and potential working contexts in an online survey of $n = 5.763$ first-year students in the UK. The topic's overall importance, according to their results, appears to be constant even after graduation. For example, a study of 98 post-graduates in the United Kingdom discovered that while students understand the value of sustainability for their careers, they are suspicious of existing approaches to delivering environmental sustainable development in higher education institutions (Opoku and Egbu, 2013).

Bandar *et al.*, (2019) mentioned that the perception of sustainability among Saudi Arabian university professors at the university where the survey was conducted reveal no clear understanding of the concept of sustainability in higher education.

Anigbogu (2011) identified some main factors that must be implemented in Nigeria for a sustainable green construction regime. It noted that increased public awareness, education, and new environmental policies are critical to the concept's adoption in the context of green construction. While Nigerian society has long relied on traditional and local materials for construction due to low prices, developers realized that the materials used in Nigeria are environmentally friendly with the rapid spread of the concept of technology. Despite this, the study concludes that formal sustainability education should be actively promoted among construction industry stakeholders, as this will help with the smooth implementation of green construction.

Nwokoro and Onukwube (2011) summarize the problems in the Nigerian construction industry, noting that “construction is a significant and primary sector of the Nigerian economy, and its consideration of sustainability issues covers a broad range of the sector.” As a result, the role of buildings in achieving long-term sustainability cannot be overstated. The general public's awareness of environmental issues has risen significantly in Nigeria. Property owners and clients are looking for commercial buildings that meet acceptable environmental and health requirements. Unfortunately, institutional guidelines supporting green buildings are lacking, as are customer, occupant, built environment professional, and other stakeholder awareness; professional capacity to integrate green building issues and opportunities; and financial resources to pursue green building growth and upgrades.

Watuka and Aligula (2002) found that 64 percent of respondents on a questionnaire sent to Architects, Engineers, Quantity Surveyors, and Contractors indicated a lack of awareness about sustainable construction practices in their study of sustainable construction practices in the Kenyan construction industry.

Babawale and Oyalowo (2011). Investigated the relationship between estate prices and sustainability despite the fact that "an increasing awareness of the need to mainstream sustainability into real estate valuation practice," the study discovered that "a respondent tended to define real estate sustainability in terms of its social, rather than economic or environmental features." This boils down to a broad grasp of the concept of sector sustainability, with expertise and education progressively filling in the gaps.

2.5 Application and integration of sustainability principles in construction

Sustainability principles have been applied to a wide range of areas in recent years. Various examples as illustrated in Table 2.2.

Table 2.2 Sustainability integration in construction

Case study	Sustainability integration in construction	Author (s)
A Energy sustainability made	Identifying sustainable energy routes needs a global energy evaluation.	Gomez-Echeverri <i>et al.</i> (2012),
	A national energy conversion scheme using hydrogen from solid fuels had its sustainability metrics for renewable energy evaluated.	Evans <i>et al.</i> (2009)
	Sustainable building HVAC created and evaluated a sustainable goal value that could be used to design and upgrade buildings.	Gnanapragasam <i>et al.</i> (2011)
B Infrastructure and buildings have been studied for their long-term viability.	describe sample studies and provide an overview of the subject	Khalid <i>et al.</i> (2015)
	Identifying sustainable energy routes needs a global energy evaluation.	Russell-Smith <i>et al.</i> (2015)
C Manufacturing activities have also been looked at for their long-term viability.	A national energy conversion scheme using hydrogen from solid fuels had its sustainability metrics for renewable energy evaluated.	Nazzal <i>et al.</i> (2013)
D Sustainability has been studied in relation to electricity, water, and environmental systems.	Sustainable building HVAC created and evaluated a sustainable goal value that could be used to design and upgrade buildings.	Krajncic and Glavic. (2005)
E Using a variety of illustrations, he quantified the longevity of technology.		Dewulf <i>et al.</i> (2000)

Source: author summary from Literature review

In a wider context, studies on regional sustainability have been carried out. Mansoori *et al.* (2016), for example, looked at state-level sustainability, while Gnanapragasam *et al.* (2011) looked at nations, and Gomez-Echeverri *et al.* (2012) looked at the entire globe. Environmental principles and behaviours are strongly regarded by both individuals and

companies, according to surveys. Engineers' perspectives on sustainability, for instance, are being explored (Rosen, 2013). The study discovered that the most critical sustainable technology goals are conserving energy and natural resources, reducing pollution and waste, and using renewable, recyclable, and recycled products, as well as the fact that there are barriers to sustainability, such as economic viability. Regulatory standards, client demand, and increasing energy costs are all likely to have an effect on green design practices and procedures. Nigerian literature on the concept of sustainability, such as Otegbulu (2011), has emphasized the importance of instilling sustainability in the construction industry, especially in the construction of homes and offices. Other study, such as Akanni and Akpomemie (2014), has demonstrated the influence of environmental factors on the performance of construction projects in the country.

However, there have been studies in the area that have looked into green building. In the construction industry, more advancements are being made in order to ensure sustainability. Zabihi *et al.* (2012) conducted research in Iran on building system sustainability assessment criteria. According to this paper, “applying sustainability assessment approaches in building systems can be useful in enhancing decision-making to use them.” It is important to integrate the concept of sustainability into the initial design process of a project. As a consequence, “effective planning and decision-making include optimized planning and decision-making in the implementation of any form of construction system, as well as in the assessment of construction systems.” Sustainability is also difficult to introduce in the construction industry since those in charge are either inexperienced or uninterested due to the financial consequences. According to Opoku and Ahmed, (2013) “the construction industry, as a key sector in the delivery of a sustainable built environment, needs to have a

clear understanding of the sustainability concept in order to truly play such a significant role”. Internal leadership within construction organizations charged with fostering sustainable practices in the sector, on the other hand, often refers to sustainability as "just an environmental problem. The construction industry is extremely important because it is interconnected with humanity in general, according to the report, and this is frequently a major challenge in the industry, especially when it comes to implementing sustainability. “Because it affects water, energy, and land use, the construction industry has a significant role to play in achieving sustainable development,” the study concludes. As a result, our research aims to bridge the gap, particularly in countries like Nigeria, where economic potential is already present.

2.6 Sustainability Courses for Promoting Sustainability Awareness and Understanding of Stakeholders in Construction Industry.

To meet the industry's current and future needs, sustainability conceptualization and practices are needed in the field of technology development (Akins *et al.*, 2019). To address the industry's concerns, it has been proposed that students in related technology disciplines receive sustainability education through a curriculum that is appropriate (Calafell *et al.*, 2019).

Sustainability activities can be incorporated into formal higher education institutions' curricula by providing students with the opportunity to become change leaders through curriculum (Chalmers *et al.*, 2016). According to the author, coursework that requires students to integrate knowledge from various disciplines can lead to increased levels of transdisciplinarity and competence development. The authors stressed the importance of

initiatives that enable students to integrate knowledge from various disciplines, as well as organizational initiatives (energy conservation, waste prevention or emissions reductions). These variables, when viewed together, may have an effect on the overall institutional strategy. ESD is being promoted as a result of critical transition factors such as the acceptance of environmental values, sustainable development viewpoints through individual initiatives that policymakers are aware of, new transdisciplinary projects, networking, and whole-institution approaches, which include concrete green campus initiatives. Working to develop a whole-of-university educational program that links the principles of sustainability being taught in the classroom with the principles of sustainability being implemented on campus is one of the most tangible ways to help students see the connections between theory and practice, as well as the relationship of their studies to the campus and the broader world (Jennifer and Rob 2009). In Italy, new educational programs on sustainable development take a more theoretical and less practical approach. The university's commitment to sustainable growth, as well as its strong involvement in the UN Sustainable Development Solutions Network project, is reflected in the curriculum, which covers topics ranging from economics and sociology to energy and transportation. The university needs to develop its curriculum development processes to make them smoother and more efficient (Aderonmu, 2012). Latest sustainable development educational projects in Italy have taken a more theoretical and less realistic approach. According to Biedenweg *et al.* (2013), sustainability training in higher education trains future practitioners to be responsible citizens in a more sustainable society, but there is little focus on instilling a deeper understanding of the ethical principles that serve as the basis for sustainability. Students are more likely to be interested in realistic activities like campus

greening programs, field trips to learn about sustainable practices, and support for environmental studies courses or workshops.

2.7 Modalities for Sustainability Understanding

Building a curriculum that teaches students how to think about sustainability and solve problems related to it is crucial. Sustainability-related courses should be included in degree programs. The three foundations of sustainability should be the focus of these classes: economic development, environmental conservation, and social well-being (Tylor and Kraly, 2012).

AASHE (2013) mention strategies that involve students in sustainability

1. The use of the school environment as a testing ground. The author discovered that the university campus is an ideal location for bringing sustainability concepts learned in class into practice. Having students responsible for the university's greenhouse gas inventory is a healthy, achievable project that will contribute to the campus's sustainability. Students for instance use the skills acquired in class to make biodiesel from waste cooking oil.
2. Develop an environmental stewardship program. The Eco-rep program is best strategy used to involve students in sustainability (AASHE, 2013). This strategy will support the school's sustainability program by increasing involvement in sustainability activities, monitoring actions, and serving as ambassadors.
3. Undertaking an independent inquiry: Students may be interested in a topic not explored in the curriculum or a theory that cannot be taught in the classroom. Using

independent research to help these students succeed (AASHE, 2013). Students may also do independent research by participating in groups.

4. Internships can either be obligatory or credited. As part of their degree program, many colleges allow or require students to complete internships during the academic year with the Sustainability Office or Facilities Department on campus, or with a local environmental organization. This enables many students have life-changing sustainability education in their experiences which they might not have opportunity in their studies (AASHE, 2013).
5. Take advantage of field trips. Even after forgetting the class's written material, students often remember a field trip to a nearby recycling plant (AASHE, 2013). Local trips can have the same effect as international travel. Field trips are beneficial academics, facilities managers, and staff to learn more about what is happening worldwide.
6. Attend a conference. According to AASHE (2013) there are conferences for almost every environmental topic, including AASHE, Green build, Net Impact, and Eco Summit. If a member of your faculty or staff is unsure about sustainability concept, bringing them to a conference.
7. Invite guests to talk. You may bring professionals into the classroom in addition to bringing students out into the field (AASHE, 2013). The author points out that at Yale's School of Forestry and Environmental Sciences, visiting practitioners often teach entire courses. In an environmental campaign class, a different speaker from Greenpeace and the Forest Alliance spoke each week. At an urban planning course, architects, government leaders, and the president of the New York Metropolitan

Transportation Authority were among the speakers. These speakers offered examples of sustainability in action as well as an opportunity to be influenced by people whose careers aligned with sustainability.

2.8 Issues in Educational System in Nigeria

The concept of education has been defined in various ways by different authorities. BBC English Dictionary defines it as “...the process through which a person is taught better ways of doing something or a better way of living,” while Obasi & Erondy (2003) define it as:

...the process by which an individual acquires or imparts

*knowledge, facts, skills, experiences, abilities and attitudes
necessary for an active and useful life in society.*

The basic objectives of education in Nigeria are encapsulated in its philosophy of education which:

*...is geared towards self-realization, better human relationship,
individual and national efficiency, effective citizenship, national
consciousness, national unity as well as towards social, cultural,
economic, political, scientific and technological progress (Federal
Ministry of Information, 1997).*

This philosophy according to the author captures the three major skills which education equips an individual with to enable him impact positively on his society – **motor skills**, **social skills** and **intellectual skills**. While motor skills are acquired mainly through technical education, social and cognitive skills are acquired through social sciences or general or liberation education. It takes the synergy of these and other skills to effectively

deal with human or societal problems and to develop society economically, socially and politically.

2.8.1 University education as general education

Even though the university system in Nigeria has not had a very smooth sail from inception, it has witnessed many successes. The successes that Nigeria has derived from the university education become apparent when one considers the five national goals through which Nigeria's philosophy of education draws its strength, namely, to create a democratic and free society, a just and egalitarian society, a united, strong and self-reliant nation, a great and dynamic economy and a land full of bright opportunities for all citizens (National Teachers' Institute, 2010).

University education is a critical component of human development worldwide. It provides the high-level skills necessary for every labour market and the training essential for teachers, doctors, nurses, civil servants, engineers, humanists, entrepreneurs, scientists, social scientists, and a myriad of other personnel (Jake Otonko, 2012). It is these trained individuals who develop the capacity and analytical skills that drive local economies, support civil society, teach children, lead effective governments, and make important decisions which affect entire societies. University education more than any other, has led to higher self-awareness and self-realization of individuals at various tasks, enhanced better human relationships, national consciousness and effective citizenship.

One cannot doubt the fact that the university education system has enhanced social, cultural, economic, political, scientific and technological progress in Nigeria.

University education has been on the vanguard of creating opportunities for the teeming Nigerian population. To build a united and egalitarian country entails that every Nigerian

should contribute to the development or up-liftment of the country (Nwangwu, 2003). The university education has continually churned out scholars who have contributed meaningfully to the world's reservoir of knowledge. There is thus growing evidence that university education, through its role in empowering domestic constituencies, building institutions, and nurturing favorable regulatory frameworks and governance structures, is vital to a country's efforts to increase social capital and to promote social cohesion, which is proving to be an important determinant of economic growth and development (Jake Otonko, 2012).

2.8.2 Polytechnic education as technical education

Technical Education has been defined as the

...instruction in a skill or procedure, usually of a mechanical type, and at a level between that of the professional scientist or engineer and that of a skilled craftsperson (Ofori-Bruku, 2005).

UNESCO and ILO (2002) define it as:

...those aspects of educational process involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life.

Technical education is a veritable means of producing the various levels and kinds of manpower required for the industrial, economic and social development of a nation. No economy or nation will thrive without the services of quantity surveyors, engineers, architects, planners, teachers, business managers, scientists and other professionals of high, middle and lower cadres.

Hewlett (2005) identified the various levels of technical manpower that make up the “Industrial Team” and elements of their training as illustrated in Table 2.3

Table 2.3 Defining the Industrial Team: From Craftsperson to Scientist

S/ N	Technical Manpower	Duties	% Theory	% Practical	Academic Qualification
1.	Scientist	Searches for and generates new knowledge	90	10	M.Sc.; Ph.D.
2.	Engineer	Designs and creates hardware and software for new knowledge and ideas; system developer	70	30	B.Sc., M.Sc. or M. Tech.
3.	Technologist	Makes design prototypes; suggests redesign or modification; acts as system dev. Engineer	60	40	HND or B.Tech.
4.	Technician	Makes models or prototypes; suggests redesign or modification, acts as system dev. Engineer	50	50	Technician Part III
5.	Craftsperson	Produces parts from complete designs, installs and runs hardware	20	80	Technical/Vocational School Certification plus on-the-job training

Source: Hewlett, D. (2005)

According to Obasi (2011) technical education, in its generic sense, is offered at three major levels, namely the high, the middle and the low. By their statutory mandate, the universities are responsible for the generation of high level manpower, the polytechnics for middle level manpower and technical/vocational schools for low level manpower. But this delineation has not been sacrosanct, as the realities of today reveal that polytechnics now also produce high level manpower while the universities also produce middle level manpower in certain disciplines. Thus while polytechnics offer National and Higher

National Diploma Programmes, some universities, in addition to degree programmes offer University Diploma Programmes in certain fields.

2.8.2.1 Problems of Polytechnic Education

The polytechnics have not made the expected impact in the society. Several factors account for this dismal state of affairs which include outdated curriculum that neither addresses the challenges and realities of a knowledge and global economy, nor targets the Millennium Development Goals (MDGs) (FME, 2006).

2.8.2.1 The Way Forward

For the polytechnics to develop their potentials fully to the benefit of the Nigerian Nation and the global community, periodic curriculum review to tailor their programmes and courses to the dynamics of our local, national and international socio-economic environments (Obasi, 2011).

2.9 An overview of studies on curriculum

Armellini and Nie (2013) found the overall impression gained from reading the selected sixty-two articles is that curriculum is a widely used concept that does not have a shared meaning in higher education research. The author opined that most of the articles took the concept of curriculum as self-evident, yet a wide variety of interpretations appeared. Curriculum was used synonymously with teaching (Ahern *et al.* 2012), programme (Alpay 2013), scheduled activities (Le Riche 2006) and course delivery.

Armellini and Nie (2013) identified that several studies suggested embedding some valuable content into the curriculum for all the students. Such initiatives included generic skills (Robley *et al.* 2005), internationalisation (e.g. Clifford 2009), entrepreneurship (e.g.

Penaluna and Penaluna 2009), sustainability (Junyent and Cell de Ciurana 2008) and inclusion (Chapman, 2007/2008).

Craddock *et al.* (2013) found that, the core content requirements were typically adopted through a top-down approach on the part of professional experts, governing institutions or industry. For example, in the medical curriculum, the health care institutions internationally (e.g. World Health Organization, WHO) or nationally (e.g. government) were identified as holding a significant role in defining content.

Selection and control over the curriculum content reflect personal, institutional, economic and policy interests, which emerged here as unidirectional enterprise. Studies focusing on the content knowledge defined by institutions, markets, academics or other experts too often seemed to take these for granted – as if it would result in a complete and independent curriculum (Armellini and Nie, 2013).

Kelly (2009) reported that when conceptualising curriculum as content knowledge to be transmitted, there is a risk that agency and identity construction from the student's perspective fully escape our attention.

Foskett (2005) suggested that a way to widen the participation agenda to which the curriculum could be designed such as to offer multiple study possibilities, despite various constraints. These benefits according to the author could be fostered when the curriculum was created in dynamic interaction with students and/or other partners

Arguments for including students as partners in curriculum processes were outlined in a study by Brew (2013), among others, who suggested a holistic model for research-based learning decision making. She stressed curriculum development that encourages thinking

about the ways to engage students in the excitement of discovering new ideas. According to Brew, education should provide support for students by preparing them to be critically reflective of the society in which they live, to develop their capacity to find and judge evidence and to be open to different knowledge in different ways. This kind of conceptualisation of curriculum helps students to take ownership of the learning and position them as co-creators of the curriculum in higher education.

There are many studies in relation to sustainability in the construction industry in Nigeria, as indicated by the above body of literature; however, our research aims to investigate students' knowledge of courses and modalities that can be incorporated into the curriculum to help students of higher learning in Nigeria develop ecological awareness, which many studies have over looked into.

Despite these researches, it is unclear if any previous studies on sustainability have concentrated on the inclusion of basic sustainability courses and modalities in the curriculum of Nigerian higher education institutions in order to instill the idea of sustainability in students. As a result, this study focuses on final-year students in university and polytechnic built environment programs in Niger state in order to close the gap.

2.10 Gap in Literature and Conceptual Model

Despite all these studies, it is however not clear that any of the past studies on sustainability has focused on inclusion of specific sustainability courses and modalities to inculcate in students the idea of sustainability in curriculum of higher institution of learning in Nigeria. This research therefore seeks to address the existing gap while focusing on the final year students in the built environment program of university and polytechnic in Niger state.

Figure 2.1 showing how perceived sustainability courses and modalities to be included in curriculum of institutions of higher learning relate to sustainability awareness of stakeholders in construction industry.

Independent Variable

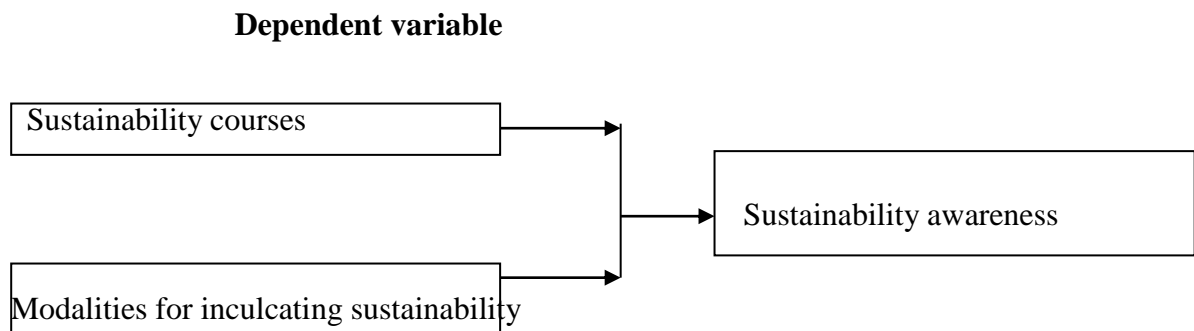


Figure 2.2 Conceptual Framework
Source: Researcher 2020

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

This study employed quantitative research design to evaluate awareness of student's in built environment on sustainability in Niger State, Nigeria. The quantitative approach seeks to find out the perception of students in higher education of learning on their awareness and understanding of sustainability principles, it applicability and their desire to integrate it to projects and to suggest sustainability courses and modalities to be included in curriculum of built environment for inculcating the idea of sustainability in students. Methodology adopted for this study is quantitative approach. Cross sectional survey technique was used. This technique allows same variables measured on one occasion for population unit at a specific point in time. Survey data collection instrument used was paper or print self-administered questionnaire. This method is useful in describing the characteristics of a large population; it is cost effective and reliable. The process involves distributing to students a paper or print questionnaire consisting of structured questions designed to elicit information into their awareness and understanding of sustainability principles, it applicability and their desire to integrate it to projects and to suggest sustainability courses and modalities to be included in curriculum of built environment for inculcating the idea of sustainability in students.

3.2 Population of the Study Area

Target population refers to the entire group of individuals the researcher is interested in generating conclusion. This study comprises students from Architecture, Quantity

Surveying, Building Technology departments in Federal University of Technology, Minna and Federal Polytechnic, Bida in Niger State.

3.3 Sample Frame

The sample frame is list of final year students in the department of Architecture, Quantity Surveying, Building Technology. The population of the study consists of the following as shown in Table 3.1.

Table 3.1: Population of final year students from sample frame

	Population size (N)	
	University	Polytechnic
ARCHITECHURE	60	36
QTY SURVEYING	112	67
BUILDING TECHNOLOGY	90	54
TOTAL	262	157

Source: School Departments record 2020

3.4 Sample Size

Sample size refers to number of respondents needed to get statistically significant results for a specific population. The representative samples of the population for the study was calculated using (Cochran, 1977) formula.

$$\text{Sample size SS} = (Z\text{-score})^2 \cdot p(1-p) / (\text{margin of error})^2 \quad (3.1)$$

Where

SS = Sample Size for infinite population

Z = Z value (e.g. 1.96 for 95% confidence level)

P = value of population proportion (expressed as decimal) (assumed to be 0.5 (50%) which is being estimated.

M = Margin of Error at 5%

Using 95% confidence level and margin of error at 5%. Therefore, Cochran, 1977 formula sample size recommended a minimum of 157 for University and 123 for Polytechnic. This sample size figure represented about 63.3% of the total population of students for the study.

3.5 Sampling Techniques

To obtain a representative sample from the heterogeneous population, a stratified random sampling technique was used to assign the proportion of the total sample size to different elements of the population. It ensures each subgroup within the population receives proper representation within the sample and provides better coverage of the population.

3.6 Sample Size Proportion Allocation

To assign the sample of 157 and 123 to respondents in university and polytechnic respectively, the researcher employed the Bourley's proportional allocation formula, (see Table 3.2).

Table 3.2 Bourley's Proportion Allocation Formula

Under Study	Population Frequency	Ni/N*n	Sample size Distribution Using Bourley's Technique
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Where:

Ni, is population allocated to respondent groups.

N is population of the study.

n is total sample size.

Table 3.3 Sampling calculations using Bourley's Technique for respondents in Federal University of Technology, Minna.

Under Study	Population Frequency	Ni/N*n	Sample size Distribution Using Bourley's Technique
ARCHITECHURE	= 60	$60/262 = 0.229 * 157$	36
QTY SURVEYING	= 112	$112/262 = 0.427 * 157$	67
BUILDING TECH.	= 90	$90/262 = 0.344 * 157$	54
TOTAL (N)	= 262		157

Source: Field survey (2020)

Table 3.4 Sampling calculation using Bourley's Technique for respondent's in Federal Polytechinc, Bida.

Under Study	Population Frequency	Ni/N*n	Sample size Distribution Using Bourley's Technique
ARCHITECHURE	= 50	$50/180 = 0.278 * 123$	34
QTY SURVEYING	= 70	$70/180 = 0.389 * 123$	48
BUILDING TECH.	= 60	$60/180 = 0.333 * 123$	41
TOTAL	= 180		123

Source: Field survey (2020)

Table 3.5: Sampling Distribution using Bourley’s Technique for respondents

	Population size (N)	
	University	Polytechnic
ARCHITECTURE	36	34
QTY SURVEYING	67	48
BUILDING TECHNOLOGY	54	41
TOTAL	157	123

Source: Field survey (2020)

3.7 Data Collection Instrument

The questionnaire was consist of general to more relevant questions to cover students' educational levels and study areas, as well as evaluating their level of knowledge of sustainability and their perceptions of sustainability courses to be included in higher education curricula. Some of the questions were adapted from a Kaduna Polytechnic sustainability survey (Mayere, 2016), while others were sourced from literature by the researcher based on the study's objectives. The majority of the questions on the questionnaire were quantitative in order to assess students' knowledge of sustainability and the inclusion of sustainability courses in the curriculum of higher institution of learning.

The questionnaire consists of four sections.

The first section contains respondent background information such as age, gender, level of educational.

The second section contains twenty questions. Respondents were asked to rate the extent to which they aware of twenty one sustainability principles in construction by putting a tick mark on a 5 point likert scale.

The third section contains twenty questions. Respondents were asked to rate the extent to which they might apply and integrate these principles in their projects by putting a tick mark on a 5 point likert scale.

The fourth section contains twenty one questions, eleven questions on sustainability courses and ten questions on modalities needed for promoting sustainability awareness and understanding of stakeholders in institution of higher learning. Respondents were asked to rate the extent to which they perceived the sustainability courses and modalities be included in curriculum for teaching and learning sustainability be given by putting a tick mark on a 5 point likert scale.

Before conducting the survey, the questionnaire was revised by my supervisor for suggestions and comments to help review and improve the instruments. Also, a pilot survey was conducted in a small sample of students consisting of ten students to check the validation of the questionnaire before being administered on a larger scale.

3.8 Method of Data Collection

Paper questionnaires was distributed to students in Federal University and Federal Polytechnic in Niger. A total of two hundred and fifty (250) questionnaires were distributed at random to final year students in Architecture, Quantity Surveying, Building Technology departments.

3.9 Method of Data Presentation and Analysis

Quantitative and qualitative methods were used to analyze the results. Content analysis was used to examine qualitative results. Quantitative data was analyzed using descriptive

statistics, including mean and standard deviation, and presented in tables using the Statistical package for Social Statistics (SPSS) tool. To measure the significance of differences in student opinions across educational levels and to determine the direction of significance differences, inferential statistics were used with the aid of Mann Whitney T-Statistics and Mann Whitney Ranking Statistics tools. Tables were used to display the findings. The interpretations were made based on the study's and research's objectives.

3.10 Decision rule

A mean score of 3.0 was used as the decision point for variable selection in order to assess the acceptance standard. If a decision rule's mean value was equal to or greater than 3.0, it was considered important. When two or more variables have the same mean, the one with the smallest variance earns the most important rating. A standard deviation of less than 1.0 indicates that the respondents are in agreement.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Questionnaires distribution

A total of 250 questionnaires were distributed to students in Quantity surveying, Architecture and Building Technology departments. However, actually, 199 (80%) questionnaire were properly filled and returned. Of 199 questionnaire returned, 99 responses were from 500 level students in University and 100 were from HND II students in Polytechnic. Out of these responses, 52 were from architecture department, 81 were from quantity surveying department, and 66 from building technology department. The analysis of data has been made based on the 199 responses.

Table 4.1 Response Rate of Questionnaires

Questionnaires distributed	Questionnaires Received	Response Percentage
250	199	80%

Source: Researcher's Analysis (2020)

4.2 Background Information of the Respondents

This section provides general information on the respondents, in relation to the age, gender, level of education and course of study.

4.2.1 Gender of the Respondents

The respondents were required to indicate their gender as one of the attributes of mapping out respondent's background information. Their responses were as provided in Table 4.2. It

was evident from the analysis that 89.4% of the respondents were male while 10.6 percent were female.

Table 4.2 Gender of Respondents

	Frequency	Percent	Cumulative Percent
Male	178	89.4	89.4
Female	21	10.6	100.0
Total	199	100.0	

Source: Researcher analysis (2020)

4.2.2 Age of the Respondents

The next attribute to be evaluated was the age of respondents and the outcome was as presented in Table 4.3. It was evident from the analysis that majority of respondents were aged between 21-25 years (approximately 91%). Five percent results of (5%) were in the 15-20 years. Three percent (3%) were within 26-30 years and one percent (1%) above 30 years. The finding indicates that the respondents are matured to provide information for this research.

Table 4.3 Age of Respondents

Age Bracket	Frequency	Percent	Cumulative percent
15 – 20 years	10	5.0	5.0
21 - 25 years	181	91.0	96.0
26 - 30 years	6	3.0	99.0
above 30 years	2	1.0	100.0
Total	199	100.0	

Source: Researcher analysis (2020)

4.2.3 Level of Education

The respondents feedback on their level of education are as presented in Table 4.4 showed that an overwhelming 50.3% are in Higher National Diploma Two (HND II) in Polytechnics, while approximately 49.7% are in 500 level in University. These results proved further that the respondents were qualified, competent and highly matured to answer questions on sustainability principles in construction is not in doubt.

Table 4.4 Level of Education

	Frequency	Percent	Cumulative Percent
500 Level	99	49.7	49.7
HND II	100	50.3	100.0
Total	199	100.0	

Source: Researcher analysis (2020)

4.2.4 Course of Study

The last attribute to be evaluated under background information was the course of study of respondents; the results reveal 30.2 % of the respondents studying architecture; 40.2% studying quantity surveying and 29.6 percent studying building technology.

Table 4.5 Course of Study

	Frequency	Percent	Valid Percent	Cumulative Percent
Architecture	60	30.2	30.2	30.2
Quantity Surveying	80	40.2	40.2	70.4
Building Technology	59	29.6	29.6	100.0
Total	199	100.0	100.0	

Source: Researcher analysis (2020)

4.3 Data Analysis and Interpretation

The Content analysis, descriptive analysis and inferential analysis were conducted. The content analysis of literature was carried out to identify sustainability principles in construction industry. To investigate the distribution of single variables, descriptive statistics were used.

If a decision rule's mean value was equal to or greater than 3.0, it was considered important (Shen and Chung, 2002; Ahadzie, 2007). When two or more variables have the same mean, the one with the smallest variance earns the most important rating. A standard deviation of less than 1.0 indicates that the respondents are in agreement.

The Mann Whitney T test statistics and Whitney Ranking Statistics were conducted in order to determine answer to objective two, three and four.

The Mann-Whitney U Test was used to test for differences between medians of two independent groups. As a general rule, if a statistically significant difference between the two groups exists, the direction of the difference (which group is higher) needs to be described from the Ranks table under the column Mean Rank of Whitney Ranking Statistics table.

Descriptive statistics, Mann Whitney T statistics and Whitney Ranking Statistics were performed using the Statistical package for Social Statistics (SPSS Ver. 20.0).

4.3.1 Sustainability principles in construction industry

The researcher sought to identify and ascertain sustainability principles in construction industry. The findings of content analysis of literatures offered a list of twenty-one sustainability principles of construction applicable throughout the whole life of building project as indicated in Table 2.1.

Table 4.6 shows sustainability principles as it is rated by respondents. Accordingly, 'Healthy environment (mean 3.714)' rated as the most important environment principle of sustainability in construction; Energy with low effect followed and thirdly 'Conserve water (mean 3.593)', Monitoring the use of space (mean 3.010). While 'Whole life value (mean 2.975)' rated as the most important economic principle of sustainability in construction, followed by 'Implement cost effective measures (mean 2.613), and lastly, Design for less material usage (mean 2.397). Monitoring the use of space (mean 3.010) rated first, use of local materials suppliers (mean 2.915)' rated second, and use of local construction labour (mean 2.673) rated third the most important social principles ascertained by respondents.

4.3.2 Awareness and Understanding of Sustainability Principles

One of the key objectives of this research was to assess the extent of agreement on awareness and understanding of sustainability principles in construction industry. The researcher conducted a descriptive analysis to examine the distribution for single variables before running the Mann Whitney T-Statistics and Whitney Ranking Statistics respectively. Sustainability principles in construction industry consisted of twenty different statements categorized under Environmental, Economic, and Social aspects that students were asked to rate the extent of their agreement on the level awareness and understanding. Students' response mean scores on extent of agreement on the awareness and understanding of sustainability principles can be seen in Table 4.6. From the analysis four variables had mean scores value above 3.0 this comprise Healthy environment (mean value = 3.714), Energy with low effects (mean score value = 3.618), Conserve water (mean value = 3.593), and Monitoring the use of space (mean score value = 3.010). Similarly, Environmentally appropriate area (mean score value = 2.834), Biodiversity and ecology (mean score value = 2.824) , Whole life value (mean score value = 2.975), Implement cost effective measures (mean score value = 2.613) , Design for less material usage (mean value= 2.397), Use durable material (mean score value = 2.251), Design to attract investors (mean score value = 2.106), Use materials from recycled source (mean score value = 2.076), Use locally manufactured material (mean score value = 1.990), use of local materials suppliers (mean value=2.915) , use of local construction labour (mean value=2.673) Maintaining natural habitat(mean value= 2.477), Firms that have a sustainability focus (mean value=2.211) ,minimization of traffic congestion (mean value=2.106) and Health assessment of materials (mean value=1.859) had mean scores below 3.0. It was observed that all the variables had

approximately 1.0 standard deviation. This implies inconsistency in agreement among the students of 500 level and HND II on rating of the variables.

Table 4.6 Descriptive Statistics on Awareness and Understanding of Sustainability Principle

	N	Minimum	Maximum	Mean	Std. Deviation	Rank
Environmental Principles						
Healthy environment	199	1.00	5.00	3.714	1.134	1
Energy with low effects	199	1.00	5.00	3.618	1.409	2
Conserve water	199	1.00	5.00	3.593	1.176	3
Environmentally appropriate area	199	1.00	5.00	2.834	1.100	4
Biodiversity and ecology	199	1.00	5.00	2.824	1.365	5
Economic principles						
Whole life value	199	1.00	5.00	2.975	1.249	1
Implement cost effective measures	199	1.00	5.00	2.613	1.258	2
Design for less material usage	199	1.00	5.00	2.397	1.490	3
Use durable material	199	1.00	5.00	2.251	1.493	4
Design to attract investors	199	1.00	5.00	2.106	1.224	5
Use materials from recycled source	198	1.00	5.00	2.076	1.209	6
Use locally manufactured material	199	1.00	5.00	1.990	1.428	7
SocialPrinciples						
Monitoring the use of space	199	1.00	5.00	3.010	1.477	1
Use of local materials suppliers	199	1.00	5.00	2.915	1.403	2
Use of local construction labour	199	1.00	5.00	2.673	1.247	3
Maintaining natural habitat	199	1.00	5.00	2.477	1.406	4
Firms that have a sustainability focus	199	1.00	5.00	2.211	1.237	5
Minimization of traffic congestion	199	1.00	5.00	2.106	1.178	6
Health assessment of materials	199	1.00	4.00	1.859	1.150	7

Source: Researcher analysis (2020)

To establish the significance level of the inconsistency in agreement among respondents on the scoring of variables. Mann-Whitney T-Statistics was carried out and the results are displayed in Table 4.7, based on information provided, significance level (p) of P= .006, .000, .000, .000, .000, .000, .006, .000, .000, .000, .000. Calculated probability value (p) is less than .05, as such, the results were significant. It is then concluded that there is statistically significant difference by level of education among the students of University and Polytechnic. This implies that respondents demonstrated awareness and understanding by agreeing on the following sustainability principles : Use of materials from recycled source, Use locally manufactured material, Use durable material, Implement cost effective measures, Design to attract investors, Design for less material usage, Use of local materials suppliers, Maintaining natural habitat, Monitoring the use of space, Health assessment of materials, Minimization of traffic congestion, Firms that have a sustainability focus and lack of awareness and understanding by disagreeing with the principles of Environmental appropriate area, Biodiversity and ecology, Conserve water , Energy with low effects, Healthy environment , Use of biodegradable, Use of materials from recycled source, Whole life value and Use of local construction labour.

Table 4.7 Sustainability Awareness Principles Mann-Whitney T-Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2- tailed)
Environmentally appropriate area	4744.000	9694.000	-.525	.600
Biodiversity and ecology	4923.500	9973.500	-.068	.946
Conserve water	4492.000	9542.000	-1.199	.230
Energy with low effects	4512.000	9562.000	-1.119	.263
Healthy environment	4710.000	9760.000	-.614	.539
Use biodegradable	4612.000	9562.000	-.864	.387
Use materials from recycled source	3859.000	8809.000	-2.737	.006
Use locally manufactured material	2914.500	7964.500	-5.671	.000
Use durable material	2235.000	7285.000	-7.226	.000
Implement cost effective measures	2824.500	7874.500	-5.376	.000
Design to attract investors	3226.000	8276.000	-4.473	.000
Design for less material usage	2292.500	7342.500	-6.863	.000
Whole life value	4410.500	9460.500	-1.372	.170
Use of local construction labour	4246.000	9296.000	-1.779	.075
Use of local materials suppliers	3866.500	8916.500	-2.737	.006
Maintaining natural habitat	2749.500	7799.500	-5.605	.000
Monitoring the use of space	3476.500	8526.500	-3.712	.000
Health assessment of materials	2572.000	7622.000	-6.536	.000
Minimization of traffic congestion	2316.000	7366.000	-6.902	.000
Firms that have a sustainability focus	2860.000	7910.000	-5.372	.000

a. Grouping Variable: Level of education

To find out the direction of the significant differences by level of education (which group is higher) Mann Whitney Ranking statistics was carried out, the results are presented in Table. Looking at the pattern of responses across the two educational levels, it was evident that 500 level students surveyed strongly disagree on biodiversity and ecology (Mean Rank =100.27), use materials from recycled source (Mean Rank =110.02), Conserve water (Mean

Rank =104.63), energy with low effects (Mean Rank =104.42), Healthy environment (Mean Rank = 102.42), whole life value(Mean Rank =105.45), use of local construction labour (Mean Rank =107.11), use of local materials suppliers(Mean Rank =110.94), design for less material usage(Mean Rank =126.84), implement cost effective measures(Mean Rank =121.47), design to attract investors(Mean Rank =117.41), use durable material(Mean Rank =127.42), maintaining natural habitat(Mean Rank =122.23), monitoring the use of space(Mean Rank =114.88), health assessment of materials(Mean Rank =124.02), minimization of traffic congestion(Mean Rank =126.61) firms that have a sustainability focus(Mean Rank =121.11) and use locally manufactured(Mean Rank =120.56), HND II students surveyed strongly disagree on Environmentally appropriate area , (Mean Rank =102.06) , Use biodegradable(Mean Rank =103.38). The most striking findings are that the direction of significance difference by level of education is significantly higher for 500 level students.

Table 4.8: Sustainability Awareness Principles Mann-Whitney T-Statistics

(See Appendix)

4.3.3 Application and integration of Sustainability principles in Construction

Another key objective of this research was to assess the extent of agreement among students to apply and integrate sustainability principles in projects. The researcher conducted a descriptive analysis to examine the distribution for single variables before running the Mann Whitney T-Statistics and Whitney Ranking Statistics respectively. Sustainability principles in construction industry consisted of twenty different statements that students were asked to rate the extent of their agreement to apply and integrate sustainability principles in projects. Students' response mean scores on extent of agreement to apply and integrate sustainability principles in projects can be seen in Table 4.9. From the analysis nine variables had mean scores value above 3.0. This includes conserve water (mean value = 3.231), design for less material usage (mean score value = 3.764), whole life value (mean value = 3.342), while Implement cost effective measures (mean score value =3.236) , maintaining natural habitat (mean value= 3.653), monitoring the use of space use of local materials suppliers (mean value= 3.442), minimization of traffic congestion (mean value=3.256), use of local materials suppliers and use of local construction labour (mean value=3.246). In line with decision rule, it means that some respondents agreed to apply and integrate one environmental principle, three economics principles and five social principles throughout the life of construction project after graduation. Similarly, eleven variables had mean scores below 3.0, which signify that some of respondents disagreed on the possibility of applying and integrating them in project. It was observed that all the variables had approximately 1.0 standard deviation. This implies inconsistency in agreement among the students of 500 level and HND II on rating of the variables.

Table 4.9 Descriptive Statistics of Applicability and Desire to Integrate Sustainability Principle to Construction

	N	Minimum	Maximum	Mean	Std. Deviation	Rank
Environmental Principles						
Conserve water	199	1.00	5.00	3.231	1.395	1
Energy with low effects	199	1.00	5.00	2.950	1.523	2
Healthy environment	199	1.00	5.00	2.899	1.341	3
Use biodegradable	199	1.00	5.00	2.698	1.676	4
Biodiversity and ecology	199	1.00	5.00	2.538	1.480	5
Environmentally appropriate area	199	1.00	5.00	2.523	1.348	6
Economic principles						
Design for less material usage	199	1.00	5.00	3.764	1.367	1
Whole life value	199	1.00	5.00	3.342	1.383	2
Implement cost effective measures	199	1.00	5.00	3.236	1.474	3
Use durable material	199	1.00	5.00	2.894	1.440	4
Use locally manufactured material	199	1.00	5.00	2.799	1.514	5
Design to attract investors	199	1.00	5.00	2.784	1.403	6
Use materials from recycled	199	1.00	5.00	2.357	1.348	7
Social Principles						
Maintaining natural habitat	199	1.00	5.00	3.653	1.444	1
Monitoring the use of space	199	1.00	5.00	3.442	1.281	2
Minimization of traffic congestion	199	1.00	5.00	3.256	1.124	3
Use of local materials suppliers	199	1.00	5.00	3.246	1.383	4
Use of local construction labour	199	1.00	5.00	3.246	1.489	5
Health assessment of materials	199	1.00	5.00	2.899	1.467	6
Firms that have a sustainability focus	199	1.00	5.00	2.447	1.423	7

Grouping Variable: Level of education

Source: Researcher analysis (2020)

To establish the significance level of the inconsistency in agreement among respondents on the scoring of variables. Mann-Whitney T-Statistics was carried out and the results are displayed in Table 4.10, based on information provided, there is statistically significant

difference by level of education ($p < .05$). This implies that some of respondents agreed on the possibility of applying and integrating the principle of environmentally appropriate area ($p = .004$), biodiversity and ecology ($p = .001$), conserve water ($p = .026$), healthy environment ($p = .001$), use biodegradable ($p = .007$), use materials from recycled ($p = .019$), implement cost effective measures ($p = .000$), design for less material usage ($p = .003$), use of local construction labour ($p = .049$), health assessment of materials ($p = .000$), and minimization of traffic congestion ($p = .000$) in project after graduation. While some of the respondents disagreed on the possibility of applying and integrating the principles of Energy with low effects (0.117), use of locally manufactured material, use durable material, design to attract investors, whole life value, use of local materials suppliers, maintaining natural habitat, monitoring the use of space and firms that have a sustainability focus in project after graduation.

Table 4.10 Applicability of Sustainability principles in Construction Mann-Whitney Test-Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Environmentally appropriate area	3808.000	8858.000	-2.892	.004
Biodiversity and ecology	3721.500	8771.500	-3.183	.001
Conserve water	4080.000	9130.000	-2.223	.026
Energy with low effects	4329.500	9379.500	-1.568	.117
Healthy environment	3570.000	8620.000	-3.474	.001
Use biodegradable	3910.000	8960.000	-2.687	.007
Use materials from recycled	4031.500	8981.500	-2.350	.019
Use locally manufactured material	4920.500	9870.500	-.075	.940
Use durable material	4525.000	9475.000	-1.070	.285
Implement cost effective measures	3446.500	8396.500	-3.793	.000
Design to attract investors	4673.500	9723.500	-.711	.477
Design for less material usage	3802.000	8752.000	-2.983	.003
Whole life value	4259.000	9209.000	-1.744	.081
Use of local construction labour	4170.000	9220.000	-1.968	.049
Use of local materials suppliers	4863.000	9813.000	-.221	.825
Maintaining natural habitat	4543.500	9593.500	-1.047	.295
Monitoring the use of space	4905.000	9855.000	-.114	.909
Health assessment of materials	3019.500	7969.500	-4.872	.000
Minimization of traffic congestion	2954.000	7904.000	-5.137	.000
Firms that have a sustainability focus	4206.500	9156.500	-1.902	.057

Grouping Variable: Level of education

Source: Researcher analysis (2020)

To establish the exact direction of the significant differences by level of education (which group is higher). Mann Whitney Ranking statistics was carried out; the results are presented in Table based on responses provided, that 500 level students surveyed strongly disagree on environmentally appropriate area(Mean Rank =111.54), biodiversity and ecology(Mean Rank =112.41), conserve water (Mean Rank =108.79), healthy environment(Mean Rank =113.94), use of local construction labour (Mean Rank =107.88) while HND II students surveyed strongly disagree on use locally implement cost effective measures(Mean Rank =115.04), use durable material(Mean Rank =104.25), use materials from recycled(Mean Rank =109.19), health assessment of materials(Mean Rank =119.31) and minimization of traffic congestion(Mean Rank =107.44). Therefore, a key finding is that the direction of significance difference by level education is significantly higher for both 500 level students and HND II students.

Table 4.11: Applicability of Sustainability principles in Construction Mann-Whitney Test-Statistics

(See appendix)

4.3.4a Sustainability courses for promoting students understanding of sustainability

Principles in curriculum

One of the last objectives of this research was to suggest education courses needed for promoting students awareness and understanding of sustainability principles. The researcher conducted a descriptive statistics to examine the distribution for single variables. The students were asked to rate sustainability courses to inculcate in them the idea of sustainability. Table 4.12 reveals a general view of the students by educational level the most effective education course. From the analysis the most effective courses are: environmental impact assessment ranked first (mean score value = 4.327), design and sustainable development was ranked second (mean value = 4.146), while fundamentals of sustainable development ranked third (mean score value = 3.950) construction waste management ranked fourth (mean score value = 3.789). While technology for sustainable ranked fifth (mean score value = 3.774), sustainable materials and products ranked sixth (mean score value = 3.704), sustainable job site operation ranked seventh (mean score value = 3.508), measuring sustainability ranked eighth (mean score value = 3.186), sustainable development ranked ninth (mean score value = 3.146) and rationale for green buildings ranked tenth (mean score value = 3.080). It is evident that mean score of courses to inculcate the idea of sustainability is within the range of 3.1-4.4. This implies that respondent strongly agreed the inclusion of nine education courses into curriculum as important technique for promoting students awareness and understanding of sustainability principles. Similarly, energy efficiency course had mean score below 3.0, which signify that the respondents disagreed on the possibility of including it into curriculum. Finally

nine of the courses (variables) out of twelve had approximately 1.0 standard deviation; this implies inconsistency in agreement among respondents on rating the variables.

Table 412 Descriptive statistics on Courses to be included in Built environment Curriculum

	N	Minimum	Maximum	Mean	Std. Deviation	Rank
Environment impact assessment	199	1.00	5.00	4.327	0.846	1
Design and sustainable development	199	1.00	5.00	4.146	0.855	2
Fundamentals of sustainable development	199	1.00	5.00	3.950	1.053	3
Construction waste management	199	1.00	5.00	3.789	1.437	4
Technology for sustainable development	199	1.00	5.00	3.774	1.458	5
Sustainable materials and products	199	1.00	5.00	3.704	1.282	6
Sustainable job site operation	199	1.00	5.00	3.508	1.381	7
Measuring sustainability	199	1.00	5.00	3.186	1.341	8
Sustainable development	199	1.00	5.00	3.146	1.249	9
The rationale for green buildings	199	1.00	5.00	3.080	1.335	10
Energy efficiency	199	1.00	5.00	2.834	1.262	11

Grouping Variable: Level of education, *Source: Researcher analysis (2020)*

To establish the degree of inconsistency in agreement among respondents on the scoring of variables. It was evidence from analysis in Table 4.13 that there is statistically significant difference by level of education ($p < .05$). Some respondents agreed on the Measuring sustainability ($p = 0.000$), Technology for sustainable development ($p = 0.000$), Sustainable materials and products ($p=0.000$), Fundamentals of sustainable development ($p=0.001$), the rationale for green buildings ($p=0.000$) environment impact assessment ($p = 0.047$) as courses to be included curriculum. While some of the respondents disagreed on Sustainable development ($p= 0.156$), Design and sustainable development ($p= 0.558$), Energy efficiency ($p= 0.422$), Sustainable job site operation ($p= 0.512$) and Construction waste management ($p= 0.338$) as courses to be included for integrating sustainability training into construction education curriculum and important technique to inculcate in students the idea of sustainability.

Table 4.13 Sustainability Courses Mann-Whitney Test-Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Sustainable development	4394.500	9344.500	-1.417	.156
Measuring sustainability	1598.000	6548.000	-8.455	.000
Design and sustainable development	4732.000	9682.000	-.586	.558
Technology for sustainable development	3409.500	8459.500	-4.016	.000
Sustainable materials and products	3217.000	8267.000	-4.434	.000
Fundamentals of sustainable development	3623.500	8673.500	-3.478	.001
The rationale for green buildings	3506.000	8556.000	-3.633	.000
Energy efficiency	4634.500	9684.500	-.803	.422
Sustainable job site operation	4692.000	9742.000	-.656	.512
Construction waste management	4584.000	9634.000	-.958	.338
Environment impact assessment	4220.000	9170.000	-1.984	.047

Grouping Variable: Level of education, *Source: Researchers analysis (2020)*

The researcher sought to describe the direction of the significant differences by level of education (which group is higher). The results as rated by 500 level and HND II in Table 4.14 show that 500 level students surveyed strongly agree on technology for sustainable

development (Mean Rank =115.56), sustainable materials and products (Mean Rank =117.51), fundamentals of sustainable development (Mean Rank =113.40), the rationale for green buildings (Mean Rank =114.59), energy efficiency (Mean Rank =103.19), Sustainable job site operation (Mean Rank =102.61), construction waste management (Mean Rank =103.70), while HND II students surveyed strongly agree on measuring sustainability (Mean Rank 133.52), design and sustainable development (Mean Rank =102.18) and environment impact assessment(Mean Rank =107.30) as sustainability courses for integrating sustainability training into construction education curriculum and important technique to inculcate in students the idea of sustainability.

Table 4.14 Sustainability Courses Mann-Whitney Ranking Statistics

Level of education		N	Mean Rank	Sum of Ranks
Sustainable development	500 Level	99	94.39	9344.50
	HND II	100	105.56	10555.50
	Total	199		
Measuring sustainability	500 Level	99	66.14	6548.00
	HND II	100	133.52	13352.00
	Total	199		
Design and sustainable development	500 Level	99	97.80	9682.00
	HND II	100	102.18	10218.00
	Total	199		
Technology for sustainable development	500 Level	99	115.56	11440.50
	HND II	100	84.60	8459.50
	Total	199		
Sustainable materials and products	500 Level	99	117.51	11633.00
	HND II	100	82.67	8267.00
	Total	199		
Fundamentals of sustainable development	500 Level	99	113.40	11226.50
	HND II	100	86.74	8673.50
	Total	199		
The rationale for green buildings	500 Level	99	114.59	11344.00
	HND II	100	85.56	8556.00
	Total	199		
Energy efficiency	500 Level	99	103.19	10215.50
	HND II	100	96.85	9684.50
	Total	199		
Sustainable job site operation	500 Level	99	102.61	10158.00
	HND II	100	97.42	9742.00
	Total	199		
Construction waste management	500 Level	99	103.70	10266.00
	HND II	100	96.34	9634.00
	Total	199		
Environment impact assessment	500 Level	99	92.63	9170.00
	HND II	100	107.30	10730.00
	Total	199		

Grouping Variable: Level of education, *Source: Researchers analysis (2020)*

4.3.4b Modalities for promoting students understanding of sustainability principles

The respondents were asked to evaluate the extent to which they agree on the modality for integrating sustainability training into construction education curriculum as important technique to inculcate in students the idea of sustainability. The outcomes presented in table 4.15 indicate that the use of the campus as laboratory ranked first (mean score value = 4.392), student to attend a conference was ranked second (mean value = 4.065), go on field trips was ranked third (mean value = 3.804), utilise the sustainability officer was ranked fourth (mean value = 3.764), encourage study abroad was ranked fifth (mean value = 3.754) and Invite speakers into the classroom ranked sixth (mean value = 3.754) as most effective ways to inculcate in students the idea of sustainability. It is evident that mean score of modalities to inculcate the idea of sustainability in students is within the range of 3.7-4.4. This implies that respondent strongly agreed the inclusion of nine modalities into curriculum as important technique for promoting students awareness and understanding of sustainability principles. Similarly, independent study to nurture student and develop faculty workshop had mean score below 3.0, which signify that the respondents disagreed on the possibility of including it into curriculum. Finally nine of the courses (variables) out of twelve had approximately 1.0 standard deviation; this implies inconsistency in agreement among respondents on rating the variables.

Table 4.15 Modality for Integrating Sustainability Training into Construction Curriculum

	N	Minimum	Maximum	Mean	Std. Deviation	Rank
Use the campus as laboratory	199	1.00	5.00	4.392	0.914	1
Student to attend a conference	199	1.00	5.00	4.065	1.151	2
Go on field trips	199	1.00	6.00	3.804	1.274	3
Utilise the sustainability officer	199	1.00	5.00	3.764	1.202	4
Encourage study abroad	199	1.00	5.00	3.754	1.148	5
Invite speakers into the classroom	199	1.00	5.00	3.754	1.135	6
Set up a voluntary eco rep program	199	1.00	5.00	3.538	1.282	7
Give credit to students on internship	199	1.00	5.00	3.432	1.361	8
Independent study to nurture student	199	1.00	5.00	2.769	1.462	9
Develop faculty workshop	199	1.00	5.00	2.678	1.278	10

Grouping Variable: Level of education, *Source: Researchers analysis (2020)*

To examine the extent of inconsistency in agreement among respondents on the scoring of variables. The results as indicated in Table 4.16 show that the probability value (p) is within the range of .012 -.260. This implies that there is statistically significant difference

by level of education ($p < .05$) as such respondent statistically significantly agreed with use of campus as laboratory ($p = 0.001$), set up a voluntary eco rep program ($p = 0.001$), independent study to nurture student ($p = 0.000$), go on field trips ($p = 0.000$), student to attend a conference ($p = 0.020$), utilise the sustainability officer ($p = 0.002$), develop faculty workshop ($p = 0.001$) as

Modalities for integrating sustainability training into construction education curriculum and important technique to inculcate in students the idea of sustainability.

Table 4.16 Modality for Integrating Sustainability Test-Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Use the campus as laboratory	3784.500	8734.500	-3.254	.001
Set up a voluntary eco rep program	3680.500	8630.500	-3.219	.001
Independent study to nurture student	3401.000	8451.000	-3.912	.000
Give credit for students on internship	4336.000	9386.000	-1.554	.120
Go on field trips	2680.000	7730.000	-5.813	.000
Student to attend a conference	4067.000	9017.000	-2.335	.020
Invite speakers into the classroom	4273.000	9323.000	-1.736	.083
Utilise the sustainability officer	3771.500	8821.500	-3.065	.002
Encourage study abroad	4523.000	9573.000	-1.125	.260
Develop faculty workshop	3679.000	8729.000	-3.230	.001

Grouping Variable: Level of education, Source: Researchers Analysis (2020)

The researcher further sought to find out the direction of the significant differences by level of education (which group is higher) the findings is presented in Table 4.17. The results as rated by 500 level and HND II show that 500 level students surveyed strongly agreed on independent study to nurture student (Mean Rank = 115.65), give credit for students on intership (Mean Rank =106.20), go on field trips (Mean Rank = 122.93), invite speakers into the class room (Mean Rank =106.84), encourage study abroad (Mean Rank =104.31), utilise the sustainability officer(Mean Rank =111.90) and develop faculty workshop (Mean Rank =112.84) as modalities to be included in the curriculum while HND II students surveyed strongly agree on use the campus as laboratory (Mean Rank =88.23), set up a voluntary eco rep program (Mean Rank =87.18), student to attend a conference (Mean Rank =91.08) as modalities to be included in the curriculum.

Table 4.17 Modality for Integrating Sustainability Ranking Statistics

Level of education	N	Mean Rank	Sum of Ranks	
Use the campus as laboratory	500 Level	99	88.23	8734.50
	HND II	100	111.66	11165.50
	Total	199		
Set up a voluntary eco rep program	500 Level	99	87.18	8630.50
	HND II	100	112.70	11269.50
	Total	199		
Independent study to nurture student	500 Level	99	115.65	11449.00
	HND II	100	84.51	8451.00
	Total	199		
Give credit for students on internship	500 Level	99	106.20	10514.00
	HND II	100	93.86	9386.00
	Total	199		
Go on field trips	500 Level	99	122.93	12170.00
	HND II	100	77.30	7730.00
	Total	199		
Student to attend a conference	500 Level	99	91.08	9017.00
	HND II	100	108.83	10883.00
	Total	199		
Invite speakers into the classroom	500 Level	99	106.84	10577.00
	HND II	100	93.23	9323.00
	Total	199		
Utilise the sustainability officer	500 Level	99	111.90	11078.50
	HND II	100	88.22	8821.50
	Total	199		
Encourage study abroad	500 Level	99	104.31	10327.00
	HND II	100	95.73	9573.00
	Total	199		
Develop faculty Workshop	500 Level	99	112.84	11171.00
	HND II	100	87.29	8729.00
	Total	199		

Grouping Variable: Level of education, *Source: Researchers analysis (2020)*

4.4 Discussion of findings

The primary focus of the research was to evaluate the construction student's awareness and understanding of sustainability principles and to suggest sustainability courses and modalities for promoting students awareness and understanding of sustainability in the institutions of higher learning.

Several important findings contributed to understanding sustainability principles in construction industry and sustainability courses and modalities for promoting students awareness and understanding of sustainability in institutions of higher learning resulted from this study.

The first objectives of the study sought to identify and ascertain sustainability principles the construction industry can adopt. The results of descriptive Statistics shows sustainability principles as it is rated by respondents. 'Healthy environment (mean 3.714)' ranked first. This finding supported Halliday's (2008) viewpoint that, in order to create a healthier atmosphere, initiatives should improve living, leisure, and work conditions, rather than endangering the health of the architects, consumers, or others by exposing them to toxins or other hazardous materials. Energy with low effects (mean 3.618)' ranked second. This finding supports the findings of Lenzen and Treloar (2002), who stated that the type and amount of energy used during the life cycle of a building material, from the manufacturing process to the handling of building materials after their end of life, can affect the flow of greenhouse gases (GHGs) to the atmosphere in different ways over different time periods. Their consumption can be dramatically reduced by rising efficiency, which is a cost-effective way to minimize greenhouse gas emissions and delay the depletion of non

renewable energy resources (Lee and Chen, 2008). The third most ranked was 'conserve water (mean 3.593)'. This result according to Cole and Larsson (1999) emphasizes the reduction in resource consumption (energy and water). This finding contradicts the findings of Ilha *et al.* (2009), who found that water management technologies and techniques are often ignored aspects of a whole-building design approach. While the most critical economic theory of sustainability in building is 'whole life worth (mean 2.975). This finding suggests that there is ample evidence to suggest that many organisations, both private and public, make building-related investment decisions based on estimates of the initial construction costs, with little or no regard for operational and maintenance costs over the life of the building (Woodward, 1997). 'Implement cost effective measures (mean = 2.613).). This result agreed by Giudice *et al.* (2005). Who opined that the concept of sustainability when applied to the construction of buildings is intended to promote the utmost efficiency and to reduce financial costs. Design decisions require choice of construction structure, building materials and building installations which are often accompanied by errors in investment through an inadequate economic control of decisions. Design for less material usage (mean 2.397). This finding emphasizes the importance of reducing the use of non-renewable resources. According to Abeysundara *et al.* (2009), this should be taken into account during the project planning and design phases, where material selection is critical and should be dependent on the materials' environmental impacts.

The most critical social theory was monitoring the usage of space (mean 3.010).

This finding backs up Haberl's (2004) statement that land is a crucial indicator of sustainability, with the potential to become an absolute indicator of long-term construction. Use of local materials suppliers (mean 2.915)' ranked second and use of local construction

labour (mean 2.673) ranked third respectively. This result reveals an in-depth consideration for a project to clearly identify and seek to meet the real needs, requirements and aspirations of communities and stakeholders while involving them in key decisions.

The second objective was to determine extent of agreement on awareness and understanding of sustainability principles in construction among students in construction across educational level.

The results of descriptive Statistics revealed inconsistency in agreement among the students on rating of the variables. This could spring out of the inaccuracies of the perceptions of the respondents, not all of them could be correct in their assessment. Some could have inaccurate if not entirely wrong perceptions. Similarly, Mann Whitney T-Statistics revealed a significance difference by education level. This result suggest that all the respondents do not share similar view on awareness and understanding of sustainability principles in construction. However, the disagreement is higher among 500 level students than HND II students. This is not surprising because HND II received the lowest score rankings almost on all the sustainability principles. This may be due to a lack of effort in promoting sustainability and incorporating it into different program curricula. It shows that there is a larger issue at hand, one that goes beyond understanding the concept of sustainability. The results show that while sustainability is not a new idea for students in higher education institutions, incorporating sustainability concepts into academic programs, curricula, and courses remains a challenge. This statement is backed by Tasneem *et al.* (2020) recommendation that providing mandatory sustainability courses as one of the steps that educational institutes can take to boost sustainability literacy is important.

The third objective was to determine extent of agreement on applicability and desire to integrating sustainability principles to construction projects among students across educational level. The results of descriptive statistics reveal inconsistency in agreement among the students on rating of the variables. Similarly, Mann Whitney T-Statistics result show a significance difference by education level. This means that not all the participants agreed to apply and integrate all the sustainability principle in practice. This statement contradicts Agombar *et al.* (2013), who claimed that most students, regardless of their research backgrounds, perceived sustainability to be important to some degree for their studies and potential working contexts, and Cotterell *et al.* (2019), who claimed that increasing students' perception of sustainability concepts increases their perceived professional relevance. The direction of difference is same for both 500 level and HND II. The respondents' thinking about implementing and incorporating sustainability may be influenced by the content and curriculum of their courses. To achieve sustainability and sustainable development, it is important to integrate sustainability into construction and project development. Such infusion can be made possible with a deep understanding and knowledge among students about how to approach sustainability effectively during their degree projects and shortly thereafter in industry (Palacin-Silva *et al.*, 2018). It is vital to raise awareness and understanding of sustainability through courses. Students should acquire in-depth knowledge of sustainable education in order to integrate sustainability into future growth (Palacin-Silva *et al.*, 2018).

The fourth objective was to suggest sustainability courses and modalities needed for promoting sustainability awareness and understanding of stakeholders in construction industry. In Table 4.16, the most effective sustainability courses to inculcate sustainability

idea in students as perceived by students includes introducing environmental impact assessment course and design and sustainable development course. The teaching of these courses according to Lauret, (2020) would enable students who are future professional have sustainability development considerations deeply integrated in their thinking, as well as enable them assess designs and developments from a human and environmental perspective. Similarly, the most effective modalities to inculcate sustainability idea in students as perceived by students include the use of the campus as laboratory and student to attend a conference. This endorsed Tasneem *et al.* (2020) suggestion that Universities play a greater role in fostering sustainability awareness among students by implementing sustainability courses that must not be offered as electives. Similarly, the author wants Universities to hold frequent sustainability seminars and lectures by inviting experts or to host sustainability conferences and encourage students to attend. This is analogous to the findings of Biedenweg *et al.* (2013), who discovered that sustainability education in higher education appears to include students in practical activities such as campus greening programs, field trips to learn about sustainable practices, and funding for environmental studies courses or workshops. According to the findings of Anigbogu (2011), formal education in the sense of sustainability should be actively promoted among construction industry stakeholders, as this will assist in the seamless implementation of green construction. Educating students about sustainability necessitates educational institutions modifying their vision, policy, teaching, and, in particular, their curriculum (Strough, 2018). As the idea of sustainability grows in the technology sector (Perez-Fogue, 2018), young graduates' sustainable mindsets must be nurtured through education.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study assessed the perception of students in higher institutions of learning in Niger State, Nigeria who would become future stakeholders in construction field on sustainability principles using a questionnaire containing 61 questions. The survey was designed to cover the student's awareness and understanding of sustainability principles, desire to apply and integrate sustainability principles in projects and, sustainability courses and modalities to be included in curriculum for teaching sustainability.

The result of analysis computed from responses received from quantity surveyors, architects and builders single out Healthy environment, Energy with low effects, 'Conserve water / power, Whole life value, 'Implement cost effective measures, Design for less material usage,' Monitoring the use of space, Use of local materials suppliers and use of local construction labour as the most significant sustainability principles in construction. The implication of this is that these principles should be given more attention in construction projects. Similarly, the study found that respondents lack awareness of sustainability principles especially when it comes to the use of materials from recycled source, use locally manufactured material, use of durable materials, implement cost effective measures, design to attract investors, design for less material usage, use of local materials suppliers, maintaining natural habitat, monitoring the use of space, health assessment of materials, minimization of traffic congestion and selection of firms that have a sustainability focus. It is also noticed a higher level of awareness of sustainability

principles among students in university than among polytechnic students. Other findings from the survey suggested that environment impact assessment, design and sustainable development, the use of the campus as laboratory, and student to attend a conference be utilised as effective sustainability courses and modalities in curriculum for teaching sustainability in higher institutions. It is obvious from the results of the study show that the desire to apply and integrate of sustainability principles is significantly higher for both university students and polytechnic students. The study focused only students as a stakeholder in sustainability awareness process in construction. Other stakeholders include University commission, Polytechnic board, and Professional regulatory boards, Universities, Polytechnics and industry.

5.2 Recommendation

Education is needed to raise technology-related sustainability awareness among students. Sustainability and its dimensions for competence growth must be included in the curriculum. Education-related degree or diploma programs must pay special attention to ensure that their curricula have enough sustainability material. Skilled registration bodies for the construction industry. The National University Commission and National Board for Technical Education should ensure that sustainability problems are integrated into higher education and training programs.

5.3 Contribution to Knowledge

The findings of the study contribute to knowledge and practice by ascertaining to what extent students agreed to understand sustainability principles and, in particular, by suggesting perceived sustainability courses and modalities to be integrated in curriculum, to

enhance the teaching of sustainability principles in institutions of higher learning. These sustainability courses and modalities are essential not only to the increase in awareness of sustainability principles but more importantly in the implementation on construction projects.

5.4 Area for Further Studies

In addition to limitations, I would like to suggest the following for future studies. Firstly, expand this current research to include more Universities and Polytechnics in each geopolitical zone in Nigeria that have students in the construction field. Secondly, in this study, I focus on students in built environment only. I suggest that researcher conduct future studies on comparative analysis amongst students in built environment and other students in engineering so as to add to the stream of research in the literature on construction stakeholders' awareness and understanding of sustainability principles construction projects. Thirdly, to investigate sustainability courses synopsis to be infused into the construction field higher education curriculum in enriching student's sustainability literacy.

5.5 Implications/Role of Quantity Surveyor in the study

The results of this study have implications for quantity surveying practice, as they will enable quantity surveyors to define sustainability concepts that can be applied during the project's planning and design stages. The quantity surveyor must be aware of the drivers for sustainability and their effect on capital and life cycle costs, as well as the technological specifications of sustainable buildings, during the design stage, so that they are developed into practical costs rather than arbitrary percentage additions.

Quantity surveyors performed the following sustainable project review at the project feasibility stage:

- The economic analysis: contrasting the net benefits of sustainability in construction project choices, as well as sensitivity and risk analysis.
- The environmental analysis: a breakdown of all environmental impacts, both short and long term, as well as costs associated with each design or development option.
- The social analysis: a breakdown of the major social problems, consequences, costs, and opportunities associated with each project choice on the client's budget.

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APPENDIX

**DEPARTMENT OF QUANTITY SURVEYING
SCHOOL OF ENVIRONMENTAL TECHNOLOGY
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
M.TECH IN QUANTITY SURVEYING**

Dear Sir/Madam,

The purpose of this questionnaire is to collect data for a research project titled “**Evaluation of Construction Stakeholders Awareness of Sustainability principles in Construction Projects in Niger State**”. The purpose of the study is to ascertain the level of understanding and knowledge of Students in Higher Institutions about sustainability concept in construction projects. As a result you are kindly and respectfully required to forward your genuine and unbiased response. All responses will be used for research purpose in partial fulfilment of Master of Technology Degree in Quantity Surveying at Federal University of Technology, Minna and the outcomes will help construction stakeholders become aware of applicability of the principles of sustainability to construction projects and provide the information on education programs and ways that would be used by stakeholders for promoting sustainability awareness in construction industry.

Thank you for your cooperation, time and thoughtfulness.

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**FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA,
NIGERIA.**

**Evaluation of Construction Stakeholders Awareness of Sustainability Concept in
Construction Projects in Niger State.**

SECTION A: RESPONDENT BACKGROUND INFORMATION

Please tick [✓] the answer where applicable for the following questions

1. Age?

15-20 years 21-25 years 26-30 years above 30 years

2. Gender

Male Female

3. Level of Education

500 vel D II

3. Course of study

Architecture Quantity Surveying Building Technology

**Section B: Awareness and understanding of sustainability principles in construction
among students studying in built environment across field of study**

The sustainability principles as collated from literature about construction industry. Indicate in the following table the level of your agreement of the sustainability principles in construction. Please rate the extent to which you agree with these principles by putting a tick mark ("✓") under: (1= Very Highly, 2= High, 3= Medium, 4= Low, 5= Very low) based on the degree of your awareness and understanding during your course.

A	Environmental Principles	1	2	3	4	5
I	Develop on environmentally appropriate area					
II	Maintain biodiversity and ecology of the site					
III	Conserve building water and cooling power consumption					
IV	Use energy source with low environmental effects					
V	Provide clean and healthy environment					
VI	Use products and material than can be recycled or are biodegradable					
B	Economic principles	1	2	3	4	5
I	Use materials from recycled sources					
II	Use locally manufactured material					
III	Use durable material					
IV	Implement cost effective measures					
V	Design to attract investors					
VI	Design for less material usage					
VII	Whole life value					
C	Social Principles	1	2	3	4	5
I	Use of local construction labour					
II	Use of local materials suppliers to invest in surrounding community					
III	Maintaining and restoring natural habitat					
IV	Monitoring the integration of the use of space to improve design and reduce in equalities					
V	Health assessment of materials and products that can affect workforce safety and health based on life cycle approach					
VI	Minimization of traffic congestion, dust and noise during the construction phase					
VII	Selection of design and construction firms that have a sustainability focus					

Section C: Applicability and desire to integrating sustainability principles to construction projects among students studying in built environment across field of study

Indicate in the following table the level of your agreement on the applicability and desire to integrating sustainability indicators in construction projects. Please rate the extent to which you think you might apply and integrate the following in your projects for sustainability assessment by putting a tick mark ("√") under: (1= definitely, 2= Very Probably, 3= Possibly, 4= Probably Not, 5= Very Probably Not) after graduation.

A	Environmental Principles	1	2	3	4	5
I	Develop on environmentally appropriate area					
II	Maintain biodiversity and ecology of the site					
III	Conserve building water and cooling power consumption					
IV	Use energy source with low environmental effects					
V	Provide clean and healthy environment					
VI	Use products and material than can be recycled or are biodegradable					
B	Economic Principles	1	2	3	4	5
I	Use materials from recycled sources					
II	Use locally manufactured material					
III.	Use durable material					
IV	Implement cost effective measures					
V	Design to attract investors					
VI	Design for less material usage					
C	Social Principles	1	2	3	4	5
I	Use of local construction labour					
II	Use of local materials suppliers to invest in surrounding community					

III	Maintaining and restoring natural habitat					
IV	Monitoring the integration of the use of space to improve design and reduce in equalities					
V	Health assessment of materials and products that can affect workforce safety and health based on life cycle approach					
VI	Minimization of traffic congestion, dust and noise during the construction phase					
VII	Selection of design and construction firms that have a sustainability focus					

Section D: Education program and ways needed for promoting sustainability awareness in construction industry

Indicate in the following table the level of your agreement on the education program and ways needed for promoting sustainability awareness in construction industry.

Please rate the extents to which you belief the following programs in teaching and learning sustainability be given attention in delivery of sustainable development skills in students by putting a tick mark ("√") under: (Strongly Agree =1, Agree =2, Undecided =3, Disagree =4, strongly Disagree=5).

A	Sustainability courses to be included in the curriculum	1	2	3	4	5
I	Sustainable development economic, social and political structures					
II	Measuring sustainability					
III	Design and sustainable development					
IV	Technology for sustainable development					
V	Sustainable materials and products					
VI	Fundamentals of sustainable construction and development					
VII	The rationale for green buildings					

VIII	Energy efficiency in sustainable construction, building and design					
IX	Sustainable job site operation					
X	Construction waste management and site protection					
XI	Environment and social impact assessment					

Please rate the extents to which you believe the following help build awareness for students and staff about sustainability issues in the construction industry by putting a tick mark ("√") under: (Strongly Agree =1, Agree =2, Undecided =3, Disagree =4, strongly Disagree=5).

B	Ways that sustainability can be integrated into curriculum to help build sustainability awareness for students and staff	1	2	3	4	5
I	Use the campus as a laboratory to apply sustainability practices learned in the classroom					
II	Set up a voluntary eco rep program that enables students to earn academic credit through peer-to-peer education					
III	Take advantage of independent study to nurture students who have ideas that cannot be implemented in a class					
IV	Give credit for students who consider internship credit with the sustainability office of the facility department on campus or a local government organization					
V	Go on field trips to learn about what other campuses are doing for sustainability or what is going on in the community					
VI	Students to attend a conference for environmental issues to get some education and inspiration					
VII	Invite speakers into the classroom to give a glimpse of sustainability in action and a chance to be inspired by people whose careers match students' aspirations.					
VIII	Utilize the sustainability officer and other staff of the college to co-teach in the classroom, conduct orientation, lead a workshop on sustainability to raise awareness among					

	students and staff					
IX	Encourage study abroad with other higher institutions to earn academic credit					
X	Develop faculty workshop by inviting faculty from other Higher institutions to teach your faculty					

Table 4.1: Respondents Background information

		Frequency	Percent	Valid Percent	Cumulative Percent
Age of Respondents	15 - 20 years	181	91.0	91.0	91.0
	21 - 25 years	10	5.0	5.0	96.0
	26 - 30 years	6	3.0	3.0	99.0
	above 30 years	2	1.0	1.0	100.0
	Total	199	100.0	100.0	
Gender	male	178	89.4	89.4	89.4
	female	21	10.6	10.6	100.0
	Total	199	100.0	100.0	
Level of Education	500 Level	99	49.7	49.7	49.7
	HND II	100	50.3	50.3	100.0
	Total	199	100.0	100.0	
Course of Study	Architecture	60	30.2	30.2	30.2
	Quantity Surveying	80	40.2	40.2	70.4
	Building Technology	59	29.6	29.6	100.0
	Total	199	100.0	100.0	

Source: Researcher analysis (2020)

Table 4.2: Perceived Awareness and Understanding of Sustainability Principle

	N	Minimum	Maximum	Mean	Std. Deviation	Rank
Environmental Principles						
Healthy environment	199	1.00	5.00	3.714	1.134	1
Energy with low effects	199	1.00	5.00	3.618	1.409	2
Conserve water / power	199	1.00	5.00	3.593	1.176	3
Environmentally appropriate area	199	1.00	5.00	2.834	1.100	4
Biodiversity and ecology	199	1.00	5.00	2.824	1.365	5
Economic principles						
Whole life value	199	1.00	5.00	2.975	1.249	1
Implement cost effective measures	199	1.00	5.00	2.613	1.258	2
Design for less material usage	199	1.00	5.00	2.397	1.490	3
Use durable material	199	1.00	5.00	2.251	1.493	4
Design to attract investors	199	1.00	5.00	2.106	1.224	5
Use materials from recycled source	198	1.00	5.00	2.076	1.209	6
Use locally manufactured material	199	1.00	5.00	1.990	1.428	7
Social Principles						
Monitoring the use	199	1.00	5.00	3.010	1.477	1

of space						
Use of local materials suppliers	199	1.00	5.00	2.915	1.403	2
Use of local construction labour	199	1.00	5.00	2.673	1.247	3
Maintaining natural habitat	199	1.00	5.00	2.477	1.406	4
Firms that have a sustainability focus	199	1.00	5.00	2.211	1.237	5
Minimization of traffic congestion	199	1.00	5.00	2.106	1.178	6
Health assessment of materials	199	1.00	4.00	1.859	1.150	7

Source: Researcher analysis (2020)

Table 4.3: Respondents Perceived Applicability and Desire to Integrate Sustainability Principle to Construction

	N	Minimum	Maximum	Mean	Std. Deviation	Rank
Environmental Principles						
Conserve water / power	199	1.00	5.00	3.231	1.395	1
Energy with low effects	199	1.00	5.00	2.950	1.523	2
Healthy environment	199	1.00	5.00	2.899	1.341	3
Use biodegradable	199	1.00	5.00	2.698	1.676	4
Biodiversity and ecology	199	1.00	5.00	2.538	1.480	5
Environmentally appropriate area	199	1.00	5.00	2.523	1.348	6
Economic principles						
Design for less material usage	199	1.00	5.00	3.764	1.367	1
Whole life value	199	1.00	5.00	3.342	1.383	2
Implement cost effective measures	199	1.00	5.00	3.236	1.474	3
Use durable material	199	1.00	5.00	2.894	1.440	4
Use locally manufactured material	199	1.00	5.00	2.799	1.514	5
Design to attract investors	199	1.00	5.00	2.784	1.403	6
Use materials from recycled	199	1.00	5.00	2.357	1.348	7

Social Principles

Maintaining natural habitat	199	1.00	5.00	3.653	1.444	1
Monitoring the use of space	199	1.00	5.00	3.442	1.281	2
Minimization of traffic congestion	199	1.00	5.00	3.256	1.124	3
Use of local materials suppliers	199	1.00	5.00	3.246	1.383	4
Use of local construction labour	199	1.00	5.00	3.246	1.489	5
Health assessment of materials	199	1.00	5.00	2.899	1.467	6
Firms that have a sustainability focus	199	1.00	5.00	2.447	1.423	7

Source: Researcher analysis (2020)

Table 4.4: Courses to be included in Construction Programs Curriculum

	N	Minimum	Maximum	Mean	Std. Deviation	Rank
Environment impact assessment	199	1.00	5.00	4.327	0.846	1
Design and sustainable development	199	1.00	5.00	4.146	0.855	2
Fundamentals of sustainable development	199	1.00	5.00	3.950	1.053	3
Construction waste management	199	1.00	5.00	3.789	1.437	4
Technology for sustainable development	199	1.00	5.00	3.774	1.458	5
Sustainable materials and	199	1.00	5.00	3.704	1.282	6

products						
Sustainable job site operation	199	1.00	5.00	3.508	1.381	7
Measuring sustainability	199	1.00	5.00	3.186	1.341	8
Sustainable development	199	1.00	5.00	3.146	1.249	9
The rationale for green buildings	199	1.00	5.00	3.080	1.335	10
Energy efficiency	199	1.00	5.00	2.834	1.262	11

Source: Researcher analysis (2020)

Table 4.5: Modality for Integrating Sustainability Training into Construction Education Curriculum

	N	Minimum	Maximum	Mean	Std. Deviation	Rank
Use the campus as laboratory	199	1.00	5.00	4.392	0.914	1
Student to attend a conference	199	1.00	5.00	4.065	1.151	2
Go on field trips	199	1.00	6.00	3.804	1.274	3
Utilise the sustainability officer	199	1.00	5.00	3.764	1.202	4
Encourage study abroad	199	1.00	5.00	3.754	1.148	5
Invite speakers into the classroom	199	1.00	5.00	3.754	1.135	6
Set up a voluntary eco rep program	199	1.00	5.00	3.538	1.282	7
Give credit to students on internship	199	1.00	5.00	3.432	1.361	8

Independent study to nurture student	199	1.00	5.00	2.769	1.462	9
Develop faculty workshop	199	1.00	5.00	2.678	1.278	10

Source: Researcher analysis (2020)

Table 4.6: Reliability Statistics for Sustainability Principles Awareness

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.955	0.956	20

Source: Researcher analysis (2020)

Table 4.7: Sustainability Awareness Principles Mann-Whitney Ranking Statistics

Level of education		N	Mean Rank	Sum of Ranks
Environmentally appropriate area	500 Level	99	97.92	9694.00
	HND II	100	102.06	10206.00
	Total	199		
Biodiversity and ecology	500 Level	99	100.27	9926.50
	HND II	100	99.74	9973.50
	Total	199		
Conserve water / power	500 Level	99	104.63	10358.00
	HND II	100	95.42	9542.00
	Total	199		
Energy with low effects	500 Level	99	104.42	10338.00
	HND II	100	95.62	9562.00
	Total	199		
Healthy	500 Level	99	102.42	10140.00

environment	HND II	100	97.60	9760.00
	Total	199		
Use biodegradable	500 Level	99	96.59	9562.00
	HND II	100	103.38	10338.00
	Total	199		
Use materials from recycled source	500 Level	99	110.02	10892.00
	HND II	99	88.98	8809.00
	Total	198		
Use locally manufactured material	500 Level	99	120.56	11935.50
	HND II	100	79.65	7964.50
	Total	199		
Use durable material	500 Level	99	127.42	12615.00
	HND II	100	72.85	7285.00
	Total	199		
Implement cost effective measures	500 Level	99	121.47	12025.50
	HND II	100	78.75	7874.50
	Total	199		
Design to attract investors	500 Level	99	117.41	11624.00
	HND II	100	82.76	8276.00
	Total	199		
Design for less material usage	500 Level	99	126.84	12557.50
	HND II	100	73.43	7342.50
	Total	199		
	500 Level	99	105.45	10439.50
	HND II	100	94.61	9460.50
	Total	199		
Whole life value				

Use of local construction labour	500 Level	99	107.11	10604.00
	HND II	100	92.96	9296.00
	Total	199		
Use of local materials suppliers	500 Level	99	110.94	10983.50
	HND II	100	89.17	8916.50
	Total	199		
Maintaining natural habitat	500 Level	99	122.23	12100.50
	HND II	100	78.00	7799.50
	Total	199		
Monitoring the use of space	500 Level	99	114.88	11373.50
	HND II	100	85.27	8526.50
	Total	199		
Health assessment of materials	500 Level	99	124.02	12278.00
	HND II	100	76.22	7622.00
	Total	199		
Minimization of traffic congestion	500 Level	99	126.61	12534.00
	HND II	100	73.66	7366.00
	Total	199		
Firms that have a sustainability focus	500 Level	99	121.11	11990.00
	HND II	100	79.10	7910.00
	Total	199		

Table 4.8: Sustainability Awareness Principles Mann-Whitney T-Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Environmentally appropriate area	4744.000	9694.000	-.525	.600
Biodiversity and ecology	4923.500	9973.500	-.068	.946
Conserve water / power	4492.000	9542.000	-1.199	.230
Energy with low effects	4512.000	9562.000	-1.119	.263
Healthy environment	4710.000	9760.000	-.614	.539
Use biodegradable	4612.000	9562.000	-.864	.387
Use materials from recycled source	3859.000	8809.000	-2.737	.006
Use locally manufactured material	2914.500	7964.500	-5.671	.000
Use durable material	2235.000	7285.000	-7.226	.000
Implement cost effective measures	2824.500	7874.500	-5.376	.000
Design to attract investors	3226.000	8276.000	-4.473	.000
Design for less material usage	2292.500	7342.500	-6.863	.000
Whole life value	4410.500	9460.500	-1.372	.170
Use of local construction labour	4246.000	9296.000	-1.779	.075
Use of local materials suppliers	3866.500	8916.500	-2.737	.006
Maintaining	2749.500	7799.500	-5.605	.000

natural habitat				
Monitoring the use of space	3476.500	8526.500	-3.712	.000
Health assessment of materials	2572.000	7622.000	-6.536	.000
Minimization of traffic congestion	2316.000	7366.000	-6.902	.000
Firms that have a sustainability focus	2860.000	7910.000	-5.372	.000

a. Grouping Variable: Level of education

Table 4.9: Reliability Statistics for Applicability of Sustainability principles in Construction

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.914	.912	20

Table 4.10: Applicability of Sustainability principles in Construction Mann-Whitney Ranking Statistics

Level of education	N	Mean Rank	Sum of Ranks	
Environmentally appropriate area	500 Level	99	111.54	11042.00
	HND II	100	88.58	8858.00
	Total	199		
Biodiversity and ecology	500 Level	99	112.41	11128.50
	HND II	100	87.72	8771.50
	Total	199		
Conserve water / power	500 Level	99	108.79	10770.00
	HND II	100	91.30	9130.00

	Total	199		
Energy with low effects	500 Level	99	106.27	10520.50
	HND II	100	93.80	9379.50
	Total	199		
Healthy environment	500 Level	99	113.94	11280.00
	HND II	100	86.20	8620.00
	Total	199		
Use biodegradable	500 Level	99	110.51	10940.00
	HND II	100	89.60	8960.00
	Total	199		
Use materials from recycled	500 Level	99	90.72	8981.50
	HND II	100	109.19	10918.50
	Total	199		
Use locally manufactured material	500 Level	99	99.70	9870.50
	HND II	100	100.30	10029.50
	Total	199		
Use durable material	500 Level	99	95.71	9475.00
	HND II	100	104.25	10425.00
	Total	199		
Implement cost effective measures	500 Level	99	84.81	8396.50
	HND II	100	115.04	11503.50
	Total	199		
Design to attract investors	500 Level	99	102.79	10176.50
	HND II	100	97.24	9723.50
	Total	199		
Design for less material usage	500 Level	99	88.40	8752.00
	HND II	100	111.48	11148.00

	Total	199		
Whole life value	500 Level	99	93.02	9209.00
	HND II	100	106.91	10691.00
	Total	199		
Use of local construction labour	500 Level	99	107.88	10680.00
	HND II	100	92.20	9220.00
	Total	199		
Use of local materials suppliers	500 Level	99	99.12	9813.00
	HND II	100	100.87	10087.00
	Total	199		
Maintaining natural habitat	500 Level	99	104.11	10306.50
	HND II	100	95.94	9593.50
	Total	199		
Monitoring the use of space	500 Level	99	99.55	9855.00
	HND II	100	100.45	10045.00
	Total	199		
Health assessment of materials	500 Level	99	80.50	7969.50
	HND II	100	119.31	11930.50
	Total	199		
Minimization of traffic congestion	500 Level	99	79.84	7904.00
	HND II	100	119.96	11996.00
	Total	199		
Firms that have a sustainability focus	500 Level	99	92.49	9156.50
	HND II	100	107.44	10743.50
	Total	199		

Table 4.11: Applicability of Sustainability principles in Construction Mann-Whitney Test-Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Environmentally appropriate area	3808.000	8858.000	-2.892	.004
Biodiversity and ecology	3721.500	8771.500	-3.183	.001
Conserve water / power	4080.000	9130.000	-2.223	.026
Energy with low effects	4329.500	9379.500	-1.568	.117
Healthy environment	3570.000	8620.000	-3.474	.001
Use biodegradable	3910.000	8960.000	-2.687	.007
Use materials from recycled	4031.500	8981.500	-2.350	.019
Use locally manufactured material	4920.500	9870.500	-.075	.940
Use durable material	4525.000	9475.000	-1.070	.285
Implement cost effective measures	3446.500	8396.500	-3.793	.000
Design to attract investors	4673.500	9723.500	-.711	.477
Design for less material usage	3802.000	8752.000	-2.983	.003
Whole life value	4259.000	9209.000	-1.744	.081
Use of local construction labour	4170.000	9220.000	-1.968	.049
Use of local materials suppliers	4863.000	9813.000	-.221	.825

Maintaining natural habitat	4543.500	9593.500	-1.047	.295
Monitoring the use of space	4905.000	9855.000	-.114	.909
Health assessment of materials	3019.500	7969.500	-4.872	.000
Minimization of traffic congestion	2954.000	7904.000	-5.137	.000
Firms that have a sustainability focus	4206.500	9156.500	-1.902	.057

a. Grouping Variable: Level of education

Table 4.12: Reliability Statistics on Educational Programs

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.912	.919	21

Table 4.13: Educational Program Courses Mann-Whitney Ranking Statistics

Level of education		N	Mean Rank	Sum of Ranks
Sustainable development	500 Level	99	94.39	9344.50
	HND II	100	105.56	10555.50
	Total	199		
Measuring sustainability	500 Level	99	66.14	6548.00
	HND II	100	133.52	13352.00
	Total	199		
Design and sustainable development	500 Level	99	97.80	9682.00
	HND II	100	102.18	10218.00
	Total	199		

Technology for sustainable development	500 Level	99	115.56	11440.50
	HND II	100	84.60	8459.50
	Total	199		
Sustainable materials and products	500 Level	99	117.51	11633.00
	HND II	100	82.67	8267.00
	Total	199		
Fundamentals of sustainable development	500 Level	99	113.40	11226.50
	HND II	100	86.74	8673.50
	Total	199		
The rationale for green buildings	500 Level	99	114.59	11344.00
	HND II	100	85.56	8556.00
	Total	199		
Energy efficiency	500 Level	99	103.19	10215.50
	HND II	100	96.85	9684.50
	Total	199		
Sustainable job site operation	500 Level	99	102.61	10158.00
	HND II	100	97.42	9742.00
	Total	199		
Construction waste management	500 Level	99	103.70	10266.00
	HND II	100	96.34	9634.00
	Total	199		
Environment impact assessment	500 Level	99	92.63	9170.00
	HND II	100	107.30	10730.00
	Total	199		

Table 4.14: Educational Program Courses Mann-Whitney Test-Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Sustainable development	4394.500	9344.500	-1.417	.156
Measuring sustainability	1598.000	6548.000	-8.455	.000
Design and sustainable development	4732.000	9682.000	-.586	.558
Technology for sustainable development	3409.500	8459.500	-4.016	.000
Sustainable materials and products	3217.000	8267.000	-4.434	.000
Fundamentals of sustainable development	3623.500	8673.500	-3.478	.001
The rationale for green buildings	3506.000	8556.000	-3.633	.000
Energy efficiency	4634.500	9684.500	-.803	.422
Sustainable job site operation	4692.000	9742.000	-.656	.512
Construction waste management	4584.000	9634.000	-.958	.338
Environment impact assessment	4220.000	9170.000	-1.984	.047

a. Grouping Variable: Level of education

Table 4.15: Modality for Integrating Sustainability Ranking Statistics

Level of education		N	Mean Rank	Sum of Ranks
Use the campus as laboratory	500 Level	99	88.23	8734.50
	HND II	100	111.66	11165.50
	Total	199		
Set up a voluntary eco rep program	500 Level	99	87.18	8630.50
	HND II	100	112.70	11269.50
	Total	199		
Independent study to nurture student	500 Level	99	115.65	11449.00
	HND II	100	84.51	8451.00
	Total	199		
Give credit for students on internship	500 Level	99	106.20	10514.00
	HND II	100	93.86	9386.00
	Total	199		
Go on field trips	500 Level	99	122.93	12170.00
	HND II	100	77.30	7730.00
	Total	199		
Student to attend a conference	500 Level	99	91.08	9017.00
	HND II	100	108.83	10883.00
	Total	199		
Invite speakers into the classroom	500 Level	99	106.84	10577.00
	HND II	100	93.23	9323.00
	Total	199		
Utilise the sustainability officer	500 Level	99	111.90	11078.50
	HND II	100	88.22	8821.50
	Total	199		
Encourage study	500 Level	99	104.31	10327.00

abroad	HND II	100	95.73	9573.00
	Total	199		
Develop faculty workshop	500 Level	99	112.84	11171.00
	HND II	100	87.29	8729.00
	Total	199		

Table 4.16: Modality for Integrating Sustainability Test-Statistics

	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Use the campus as laboratory	3784.500	8734.500	-3.254	.001
Set up a voluntary eco rep program	3680.500	8630.500	-3.219	.001
Independent study to nurture student	3401.000	8451.000	-3.912	.000
Give credit for students on intenship	4336.000	9386.000	-1.554	.120
Go on field trips	2680.000	7730.000	-5.813	.000
Student to attend a conference	4067.000	9017.000	-2.335	.020
Invite speakers into the classroom	4273.000	9323.000	-1.736	.083
Utilise the sustainability officer	3771.500	8821.500	-3.065	.002
Encourage study abroad	4523.000	9573.000	-1.125	.260
Develop faculty workshop	3679.000	8729.000	-3.230	.001

a. Grouping Variable: Level of education