

EXPLORING TRANSVERSAL GREEN SKILLS REQUIRED OF TECHNOLOGY GRADUATES FOR ENVIRONMENTAL SUSTAINABILITY

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ABSTRACT

The main aim of this study is to explore transversal green skills required of technology graduates for environmental sustainability. Thematic analysis was used for this study. Cluster sampling technique was used to sample four states out of seven states mentioned in the area of the study and all the 18 technical colleges and 6 building construction firms in the four sampled states in north western Nigeria were used. Purposive sampling was used to select 27 experts based on their working experience and educational qualification in building construction to participate in the qualitative segment of this study. For the qualitative section, interview guide/protocol was developed based on the specific objectives of the research. It was made up of 3 open-ended questions designed to obtain sufficient information on the area of transversal green skills considered appropriate for the study. To ensure reliability of qualitative result of this research, two procedures were followed; member checking and peer debriefing. For the validity of the findings of this study, the researchers used member checking to determine the accuracy of the findings. The results of the data obtained from the interview was analyzed and interpreted using

transcription, coding, thematic, content analysis and categorization. The findings for this study include Reflective Thinking Skills, Presentation Skills, Resourcefulness Skills and Application Skills. The study recommends that Federal and state Governments should via NBTE adopt and ensure proper implementation of this findings for technology graduates at technical colleges in Nigeria with the aim of achieving environmental sustainability.

Keywords: *Exploring, transversal green skills, technology graduates, environmental sustainability.*

1.0 Introduction

Apparently, Skills can be difficult to define and measure at an aggregate level because they are a socially constructed concept, intangible and often unobservable [1]. Consequently, Shuaibu [2] notes that workers in the 21st century need a variety of skills to face realities which advancement in information and communication technology brought; concepts such as globalization, deregulation and sustainability among others. Taking sustainability into cognizance, it is all about the prospect of the society, for current industries and businesses as well as commercial success. Sustainability as a state in which humankind is living within the carrying capacity of the earth has the capacity to accommodate the needs of existing populations in a

sustainable way and is therefore also able to provide for future generations. [3].

With regard to this, it is appropriate henceforth to note that skills for sustainability which is popularly known as green skills or skills for sustainable development by authors like [4-6]. It was on this note, MacDonald noted that Australian Green Skills Agreement viewed green skills, as the technical skills, knowledge, values and attitudes needed in the workforce to develop and support sustainable social, economic and environmental outcomes in business, industry and the community.

Inclining green skills to technology, it is sufficient to define green skills as technical skills, knowledge, values and attitude needed in the building construction industries to develop and support sustainable social, economic and environmental outcomes in the building construction industry. Consequent

upon, factors like world economic downturn and ecological problem in which building is one of the contributing factors to the later pose many countries in the world to adopt the transition to a greener economy by embedding green skills into various occupations.

The report further emphasized that the programme will create at least 5,000 decent green jobs particularly for young people and improve the quality of at least 2,000 jobs in MSMEs, which in turn will improve the incomes and livelihoods of at least 8,000 households that depend on the building construction sector. Accordingly, Strietska-Iliina, Hofmann [7] reported that study of 21 countries conducted by ILO, which represent 60 percent of the world population, shows that economies moving towards greener production can seize the potential for job creation if they deal effectively with the coming structural change and transformation of existing jobs. Hence, the pace of skill needs and change in labor markets is increasing by the shift to a green economy. With regards to this, transformation to a green economy will not only generate new jobs but will also change the scope and character of existing jobs [8].

They [8] further emphasized that providing green skills require a revision of existing curricula, qualification standards and training programmes, retraining of teachers and trainers. This indicates that employers and training providers need to work in a long-term partnership to bring about these changes. The above changes clearly show that linking of green economy to sustainable development via developing green skills in technology, with supportive national policies and institutions in place will give a positive response in Nigeria. More specifically, it is pertinent to note that, technology's objective is geared towards creating skilled, competent, employable and sustainable technology graduates that can favorably fit into present green skills demanding labor market. Hence, that is what this study will accomplish by exploring transversal green skills required by Nigeria technical colleges graduates for environmental sustainability.

1.1 Background of the Study

Goals and objectives of TVET are numerous which vary from country to country. In Nigeria, the main objective of TVET is the inculcation of practical and applied skills as well as basic scientific knowledge in students for useful living in the society [9]. In the same

vein, technology education according to Pavlova [10], provides an opportunity for students to understand the nature of technology and its relationships with society and the environment, and to design and make products and systems in accord with the principles of sustainable development which take into account different dimensions of development such as social, economic and environmental. Technology education in Nigeria as part of the formal education system is incorporated into the three levels of education (primary, secondary and tertiary) with a view to meeting the nation's need for the skilled workforce and support the economic state of individual and the nation in general.

At the secondary school level, the National Board for Technical Education (NBTE), established in 1977, is the principal organ of Federal Ministry of Education specifically created to handle all aspects of technology education falling outside university education. In addition to providing standardized minimum guide curricula for technical education, the board supervises and regulates, through an accreditation process the programmes offered by technical institutions at secondary and post-secondary

school levels apart from the university level [11]. Similarly, In the Nigerian educational system, technical colleges offer technical education programmes for producing middle-level skilled workforce required for the nation's economic and technological development. Courses undertaken at those technical colleges include Building Construction Trade (BCT), Auto mechanic trade (AMT), Metal Work Trade (MWT) and Electrical/Electronic Trade (EET).

It is a clear fact that the curriculum of technology is primarily aimed at giving training and imparting the necessary skills leading to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self-reliant [12]. Craftsmen in the industry play a very crucial role in the survival and growth of the industry as they are mostly engaged in the practical realization of construction projects. This clearly indicates that, on successful graduation, technology graduates are expected to acquire the necessary skills needed for the world of work. For the Pavlova [10], the essence of technology education (which of course include building construction) is to involve students in learning through designing and making products and systems within the

model of sustainable development. To this end, it is considerably important to note that, in order to achieve truly sustainable development especially in building construction area, which ranked among the number one energy consumers and greenhouse gas emission sector we need to balance social, environmental and economic, sustainability factors simultaneously. In line with this, Joseph and Tretsiakova-McNally [14] remarked that buildings are the largest energy consumers and greenhouse gases emitters, both in the developed and developing countries. More so, in the United States for example, the building sector consumes 49% of all energy produced in the United States [15], whereas in Germany, [16] reported that the existing building stock even accounts for a share of 30% of the final energy use. This, of course, hinders the environmental, economic and social sustainability of such countries. With regards to sustainability, Illankoon, Tam [17] pointed out that the construction industry is unique in nature, it is worth discussing the concept of sustainability in a construction industry context.

With respect to the aforementioned dimensions of sustainability environmental

in building construction sector involves the responsible use of raw materials; energy, water and awareness of the impacts of production processes and environmental auditing system. In line with this, Majumdar [18] maintained that environmental sustainability as the first pillar of sustainability requires a change from "business as usual approach" to sustainable development approach of using natural resources wisely, minimizing waste and limit damage to the atmosphere and check harmful climate change [19, 20]. Moreso, the environmental dimension of sustainability is identified by some criteria and components: pollution, water consumption, waste management, greenhouse gas emission, use of durable materials, use of material with low health risk, use of renewable energy and environmental footprint. These criteria are in addition to responsible sourcing of material, use of locally available materials, recycling of components and materials, sensitive land protection, protection of ecological features, biodiversity and influence on outdoor microclimate [20-22].

Building from the above, consequently, in January 2012, The United Nations Secretary-General Ban Ki-Moon stated that environmental, economic and social indicators

tell us that our current model of progress is unsustainable: climate change is destroying our path to sustainability; and hence, ours is the world of looming challenges and increasingly limited resources. Sustainable development offers the best chance to adjust our course [23].

In explaining further, National Bureau of Statistics [24] maintained that sustainability describes the interconnectedness of a healthy environment, social justice, equity and economic vitality. To this effect, UNESCO [25] reported that sustainability cannot be reached through technological solutions or financial instruments alone. Achieving sustainable development requires a change in the way people think and act. This change can be attained by; systematically integrating Education for Sustainable Development (ESD) at all levels and settings of education and training, from early childhood to higher education and workplace learning. This training prepares learners for fields of work and business such as construction, waste management, and agriculture, many of which consume enormous amounts of energy, raw materials, and water.

In furtherance to UNESCO's assertion, Acedo [26] demonstrate that there can be no sustainable development without education and without appropriate green skills for employability especially in the building construction sector. While Nigeria, as a developing country remains inactive on issues on sustainability. To support this assertion Dania, Larsen [27] maintained that Nigeria is lagging behind world developments associated with sustainability within the construction sector and beyond. In this regards, skills development that increases employability, in the form of technical and vocational education and training (TVET), and that supports the greening of economies, has a key role to play since TVET prepares learners for fields of work and business such as construction, waste management [23]. In a careful examination of the UNESCO's assertion, it can be deduced that there is an urgent need of integrating green skills into the field trades curriculum such as technology being one of the core arms of TVET to enhance the nation's sustainable development.

Moreover, the TVET community needs to promote awareness of the demand for sustainability and green skills, and not only in new professions like the bio-energy sector. In

every industry or production cycle, natural resources and chemical inputs are used, and emissions and wastes generated—in growing vegetables, manufacturing shoes, or construction [28]. In concise, a preliminary study conducted by Hamza, Musta'amal [29] revealed that Nigerians are aware of green skills when related to sustainability/sustainable development especially in their respective occupations and they support for its embedment into various occupations for the achievement of sustainable development in Nigeria.

More so, the following list summarizes the main core skills necessary for green jobs identified in the country reports as per reported by [30] to include;

In the same vein, in compiling different green skills areas identified by Sack [22] the following green skills typology that are found in the workplace were identified to include: waste minimization, recycling and reusing materials, avoiding hazardous or toxic materials, energy skills, carbon emission skills and water efficiency skills. Additionally, Knibb and Paci [31] identified green skills typology for technical and technology-based college programs to

include specialist technical skills, broad-based technical skills, transitioning skills, and skills for sustainability (transversal skills). However, Pavlova [32] advocates that although all types of green skills contribute to greening growth, the ways they will be changing through peoples' working life can be different. Generic green skills (enriched generic skills) will be more constant across different occupations the person will be involved in during the working lifespan. Specialized green skills will be changing depending on the specific occupation.

Considering the influence of energy efficiency to achieving sustainability Uzoma, et al. (2012) noted that energy availability, economic growth and sustainable development always goes hand in hand; and hence, in solving energy supply constraints prospective energy mix should be environmentally friendly, sustainable and efficient. Evidently, building construction could be linked to the green skills concept in various ways such as site selection and preparation, construction, operation/use and renovation/demolition in order to enhance sustainability using the trade by constructing and managing sustainable constructions. In essence, Aliagha, Adnan [33] posit that passive design takes into

consideration building orientation and layout to reduce the absorption of heat from the sun, enhance inflow of daylight, provision of sun shading devices and wall greenery. This clearly indicated that there is a growing gap between demand for quality installations in buildings and the skilled and qualified labor required to do the work. Additionally, Kamana and Escultura [34] noted that green building or sustainable building as an outcome of a design which focuses on increasing the sufficiency of resource use: energy, water, and materials while reducing building impacts on human health and environment during the building's lifecycle through better location, design, construction, operation, maintenance and removal. Therefore, this practice elaborates and support the classical building design, where which concerns of utility, economy, comfort and durability.

However, the aforementioned development entails the need for appropriate training programs and curriculum content for providing relevant information to institutions, construction industries, employees among others to partner in developing green skills, especially in the building construction sector. Consequently,

McCoy, O'Brien [35] opined that appropriate training programs and curriculum content are essential mechanisms for providing this information to industry and employees, and a variety of educators, from universities to certification programs, must ensure their courses provide the industry what is necessary to promote the adoption of green skills. He further emphasized that the negative environmental impact of buildings to the environment usually led to a clamour for improved practice. Regarding this, attempts of implementation of environmentally friendly principles to the entire construction projects phases are as a result of such clamour and have been linked to the evolution of evolving concept termed "green building [36].

To this end, for long, concerted effort has been made by the Nigerian government and the educational institutions to ensure that graduates of technical institutions possessed adequate skills to get fit into the world of work irrespective of the changing technologies. The projection is that if Nigerian graduates are adequately prepared through skills oriented academic system of technical-vocational education and training (TVET) programs, many skills outlets would be nurtured and developed in the students for paid jobs or self-

gainful engagements. This would reduce the rate of the search for government paid labor [37].

With regards to the above-mentioned issues of acquiring adequate skills irrespective of the changing technologies by technical schools' graduates in Nigeria, economic recession, ecological problem and important of green skills in constructing energy efficient building with the aim of enhancing sustainability in Nigeria, many research findings indicated that these graduates are found short-skilled in working in the construction industries. To this end, Afeti [38] Pointed out that a large number of graduates (including technology graduates) coming out from the formal school system are not employed despite the opportunity abound for skilled workers. Similarly, McCoy, O'Brien [35] opined that appropriate training programs and curriculum content are essential mechanisms for providing this information to industry and employees, and a variety of educators, from universities to certification programs, must ensure their courses provide the industry what is necessary to promote the adoption of green skills. It is against the above background; the researcher deems it

very important to explore transversal green skills required by technology graduates for environmental sustainability in Nigeria.

1.2 Statement of the Problem

The adoption of Brundtland Report of 1987 paved way for many countries to a new thinking about sustainability which brought the emergence of new improvement in terms of the environmental, economic and social development of such countries in which Nigeria is not an exception. To this end, in 2010 UN-HABITAT organized a conference in Nairobi where experts, practitioners, and decision makers from twenty African countries including Nigeria declared their support and determination to promoting and fostering Green Building Rating Systems (GBRS). Accordingly, Umar and Khamidi [39] reported that the ideas and plans instituted by these world events have inspired actions by many countries to implement and incorporate sustainability principles within their built industry. They (Umar and Khamidi) identify the green building as the Subset to the principle of sustainability. This clearly indicated that through the concept of green building, construction industries can immensely contribute in a proactive and positive manner to the environmental,

economic and social sustenance in Nigeria and will on one way or the other contribute positively in rescuing the country from its current economic recession as per informed by the president [40]

Technology graduates are expected to work in the construction industries as craftsmen or other skilled personnel among others. The Nigerian government, however, made a concerted effort towards improving the building construction sector in the country due to its impact on boosting the economy and addressing the environmental challenges. To this effect, in 1978 and 2007, Nigerian Building and Road Research Institute (NBRRI) and National Environmental Standards and Regulations Enforcement Agency (NESREA) were established with a view to conducting integrated applied research & development (R&D) in building, road and construction sectors of the economy. With all the above efforts of the aforementioned agencies, construction sector remains short skilled. Similarly, Lill [41] revealed a number of factors which have combined to influence the construction skill shortfall, some of these include; The introduction of new technologies which have reconstituted the

skill required. Under the circumstances of the global economic downturn, ecological problem and the considering sustainability as a path to sustainable development, Knibb and Paci [31] suggest that the first stage to positively and urgently to address such issues would be to consider incorporating green skills in all curricula, to enable those who have been trained to be better able to adapt to changing circumstances. This is because green skill is one of the skills that will be used to address the problem of skill shortage in the building construction industries due to the emergence of new technologies. The rationale behind the selection of green skills for this study is because it encompasses environmental, economic and social elements which if properly covered will enhance the Nigeria's zeal towards achieving sustainable development.

To this effect, Damina et al (2013) reported that Nigeria appears to be lagging behind in its pursuit of the sustainability agenda. In essence, Awe, Stephenson [42] linked skill labor shortage in the construction industries in Nigeria to defective curricular with too much emphasis on paper qualifications at the expense of skills acquisition. Yet academic work related to green skill issue is relatively

sparse and in particular, none is known of the consequences of such situations with reference to Nigeria. This clearly indicated if measures are not taken on the curriculum, construction industries will remain short skilled which in turn will continue to delay or rather bedeviled the effort of Nigeria in achieving millennium development goals on sustainable development. In respect of the aforementioned, therefore, this research will focus on exploring transversal green skills in technology at technical colleges in Nigeria. Technical colleges were selected for the research with the sole aim of addressing the problem from the grass root. The successful integration of transversal green skills into the technology curricular and acquired by graduates would optimize environmental sustainability in Nigeria.

1.3 Objectives of the Study

The main objective of this study is to explore appropriate areas of transversal green skills elements that are required by technology graduates as a remedy to environmental sustainability in Nigeria.

1.4 Objectives of the Study

What are the appropriate areas of transversal green skills elements that are required by

technology graduates as a remedy to environmental sustainability in Nigeria?

1.5 Literature Review

Transversal green skills are considered to be key skills for the 21st Century workplace and ‘career capital, they complement, and can be integrated into, existing models for generic skills, essential employability skills, or so-called ‘soft’ skills and require ‘deep’ learning. Examples: systems thinking, capacity to solve complex problems, civic responsibility, accountability for the consequences of one’s actions, ethical/moral decision-making, the capacity to work in intergenerational, culturally diverse environments. Transversal skills refer to foundation skills, at their most fundamental, as "literacy and numeracy skills necessary for getting work that pays enough to meet daily needs [23].

Additionally, for Sterling [43] transversal skills prepare people to cope with, manage and shape social, economic and ecological conditions characterized by change, uncertainty, risk and complexity. In the same vein, Asia-Pacific Education Research Institutes Network (ERI-Net) [44] sees the term transversal skills which they termed as

non-cognitive skills as part of holistic development of learners, often not taught explicitly in classrooms and not assessed in conventional exams and upon which they classified transversal skills into critical and innovative thinking; interpersonal skills; intrapersonal skills; and global citizenship. According to this report, critical and innovative thinking involves creativity, entrepreneurship, resourcefulness, application skills, reflective thinking, and reasoned decision-making.

It is on the above note that the findings of regional study conducted by Asia-Pacific Education Research Institutes Network (ERI-Net) [44] recommended that the report will be a key resource for countries in the region to apply to education policy and contribute to progress in implementing and incorporating transversal skills into education curriculum. More so, UNESCO [45] revealed that the main focus of the eighth booklet in the Asia-Pacific Education System Review Series is on 'transversal skills' in Technical and Vocational Education and Training (TVET) from the educational and labor markets perspectives. It was stated that by educational perspective transversal skills goes beyond foundational

and occupation-specific skills and can give TVET graduates a comparative advantage when looking for employment and from the labor market perspective, are skills that are increasingly in high demand by employers because they can allow workers to better cope with daily challenges in rapidly changing and sophisticated workplaces.

Going by the above-mentioned report of UNESCO transversal skills could be seen as those skills that should be acquired from school and be utilized in the place of work, which in turn brings about the boosting of industries to ensure sustainable life in the community. Additionally, in Malaysia, Australia, and India for instance, Asia-Pacific Education Research Institutes Network (ERI-Net) [44] reveals the positioning of the key policy documents that appeared in the ten country/economy research reports and hence, transversal skills or competencies are integrated into the education systems in a variety of ways, from government legislation to curriculum and education programs, both explicitly and implicitly. In Malaysia, while transversal competencies are embedded in education policy and curricula there is no specific term used to refer to this set of skills and competencies, such as 'non-cognitive

skills', 'transversal skills', '21st-century skills' or 'soft skills. However, these skills and competencies are explicitly integrated into learning [44]

In Australia, transversal competencies are explicitly and implicitly incorporated into the curriculum models; while none of the policy documents examined in the case study explicitly mention terms such as non-cognitive or transversal skills, the development of these capabilities are embedded in the curriculum and learning models that guide the Australian education system. While in India, transversal competencies are implicitly included in education policy, and the National Curriculum Model – 2005 (NCF 2005) provides directive for inclusion of transversal skills in the curriculum.

In consequence, Ramos [46] posited that transversal skills are both shaped early in the lifecycle and have an important impact on social and economic success in later life. For UNESCO [47] transversal skills are included under life skills which are understood as the ability for self-development and eagerness to learn and explore new knowledge and specific

subjects are designed to impart life skills alongside traditional subjects such as languages, mathematics, and science, among others while elements of life skills are also integrated into teaching and learning of occupational skills, electives and extra-curricular activities. In the light of the above skills, European Commission. Education and Agency [48] outlined the following transversal skills as the life skills that could be required in any organization which of course include building construction industries:

- Capacity to organize oneself, to plan the tasks and the priorities
- Capacity to integrate socially within the company, to adapt to the various actors and to understand the position occupied in the hierarchy
- Being able to learn permanently and to adapt to new technologies
- Being able to anticipate and take initiatives
- Being able to work in autonomy and being proactive in case the instructions are not clear (capacity to reformulate and to ask for more information).
- Being able to solve problems, (orientation to seek the most appropriate and

effective answers to difficult situations and complex themes trying different ways).

- **Interpersonal Effectiveness:** ability to understand the perceptions, needs, attitudes of others and interact in a constructive way.

- **Result orientation:** the ability to direct constantly their own and others work to achieve the organizational goals influencing actively the events and providing a level of performance consistent with the nature and importance of the goals.

- **Decision:** ability to choose among different alternatives with thoughtfulness, clarity, timeliness under uncertainty situations, scarcity, complexity

- **Stress tolerance:** the stability of the performance in conditions of difficulty and conflict through lucid and balanced reactions and the ability to confront and control situations that arise contrasts within groups and tension in interpersonal relationships.

- **Self-assessment skills:** ability to self-observe and self-judge own actions, resources, and skills, in the coincidence between who observe and who is observed,

- **Spirit of initiative:** proactive, ability to implement actions and behaviors independently.

In addition to the above skills, practical support measures should be developed to assist the implementation of transversal skills education in TVET institutions. National guidelines alone are not sufficient to make transversal skills education effective unless these are complemented by measures, such as targeted teacher training, development and sharing of best practices, development and use of practical manuals and incentives for employer engagements; policies outlining such measures can be included in a comprehensive national strategy for the development of transversal skills education in TVET [47]. With regard to this European Union [49] maintained that employability of individuals is not only based on specific skills, but transversal skills that range from problem-solving to interpersonal skills are considered important because having these skills, which can be transferred from one context to another, is a good basis for accumulation of specific skills required by a given job.

1.6 Methodology

This section presents the methodology on how the data was collected, organized, analyzed and interpreted. The common strategies available in research methodology are quantitative, qualitative and mixed methods [50-53]. This study employs thematic methods approach which is typically based on pragmatic worldview [50] that involves the collection of qualitative data in the design. Qualitative research according to Bengue, Onwuegbuzie [54] is an approach to exploring and understanding the meaning individuals or groups ascribe to a social or human problem; while, quantitative research is an approach for testing objective theories by examining the relationship among variables.

Aligning the foregoing explanations to the current study; the researchers collected the data qualitatively by interviewing a smaller sample of the population respondents (Administrators, Teachers, Craftsmen, Workshop Instructors and Professionals) with a view to identifying their diverse opinions on the level of appropriateness of the areas of transversal green skills required by technology graduates for environmental sustainability. At the second instance, the data collected were analyzed and

interpreted. For the data collection in this study, considering the nature of its objectives of requiring knowledgeable and experience personalities, non-probability purposive/judgmental sampling technique was used to select 27 respondents that possessed at least bachelor degree with a minimum of 15 years post qualification cognitive experience.

This sample is made up of; six (6) administrators, twenty-one (21) teachers and nine (9) professionals that were participated in the interview session. [55] pointed out that in non-probability purposive sampling technique, researchers deliberately choose persons and places to study or comprehend the main phenomenon; the criteria utilized in the choice of respondents is whether they are knowledgeable about the phenomenon. For the qualitative section, interview guide/protocol was developed based on the specific objectives of the research. It was made up of 3 open-ended questions designed to obtained sufficient information on the area of transversal green skills considered appropriate for the study. In order to ascertain the reliability of qualitative instrument of this study, examination of trustworthiness is crucial. Trustworthiness generally refers to the credibility of a researcher's findings (Robert, et

al 2006). This simply signifies that the designing, the data collection procedures and reporting of the study [56]. Its applicability is based on triangulation i.e., cross checking the facts and learning to understand the ideas presented [57].

This sample is made up of; six (6) administrators, twenty-one (12) teachers and nine (9) professionals that are to participate in the interview session. [55] pointed out that in non-probability purposive sampling technique, researchers deliberately choose persons and places to study or comprehend the main phenomenon; the criteria utilized in the choice of respondents is whether they are knowledgeable about the phenomenon. For the validity of the findings of this study, the researchers used member checking to determine the accuracy of the qualitative findings through taking the final report or specific descriptions or themes back to participants. The results of the data obtained from the interview was analyzed and interpreted using transcription, coding, thematic, content analysis and categorization as suggested by [58] for data of this nature. Therefore, in this chapter results of the analysis were presented in the tables.

1.7 Data Analysis and Findings

In analyzing the data that dealt with the appropriate areas of transversal green skills, the research question was further sub-divided into two questions followed by three probing questions. Based on these two questions, opinions were collected on areas of transversal green skills. Thematic analysis was used in analyzing the interview and the result was transcribed, coded, and categorized into four subthemes. The participants were asked about their experience, ideas, perspectives or views on the elements and relevance of transversal green skills for technology graduates. The interview analysis focused on the opinion of the respondents of the relevance of integrating green skills in technology; and areas of transversal skills elements that are suitable for the integration. Based on the qualitative data collected, 25 (93%) interviewees identified transversal skills as a factor in the attainment of *environmental Sustainability*. On the issue of appropriate areas of transversal green skills, data analysis of the in-depth interview outcomes generated four themes: (*reflective thinking skills, presentation skills, resourcefulness skills, and application skills*) as presented in Table 1.

Table 1 Summary of Appropriate Areas of Transversal Green Skills

Respondent	Theme 1	Theme 2	Theme 3	Theme 4
	Reflective Thinking Skills	Presentation Skills	Resourcefulness Skills	Application Skills
<i>GS (1,15, 26, 4, 17, 25, 5, 14, 23, 7, 10, 20, 9)</i>	<i>Reasoning and Decision-making skills</i>	<i>communication skills</i>	<i>Self-discipline</i>	<i>Enthusiasm and Perseverance</i>
<i>GS (2, 19, 21, 3, 12, 18, 5, 14, 23, 8, 13, 22, 16, 24)</i>	<i>Empathy skills</i>	<i>Media literacy skills</i>	<i>Self-motivation</i>	<i>Conflicts resolution</i>
<i>GS (1, 15, 26, 3, 12, 18, 5, 14, 23, 6, 11, 27, 9, 16, 24)</i>	<i>Planning skills</i>	<i>Information literacy skills</i>	<i>Self-management skills</i>	<i>Creativity skills</i>
<i>GS (2, 19, 21, 4, 17, 25, 6, 11, 27, 8, 13, 22)</i>	<i>Compassion skills</i>	<i>Expression of ideas through media</i>	<i>Obtain information through ICT.</i>	<i>Organising skills</i>
<i>GS (1, 15, 26, 4, 17, 25, 7, 10, 20, 8, 13, 22)</i>	<i>Integrity skills</i>	<i>Expression of ideas through ICT</i>	<i>Analyse information through ICT.</i>	<i>Application of numeracy</i>

<i>GS (2, 19, 21, 3, 12, 18, 6, 11, 27, 7, 10, 20, 9, 16, 24)</i>	<i>Commitment skills</i>	-	-	<i>Application of information technology skills</i>
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Table 1 presents the result of the qualitative data analysis on appropriate areas of transversal green skills elements considered suitable for integration in Technology based on the four themes enlisted above. GS1-GS27 represents experts’ classification, while theme 1–4 was emerged from the analysis of the in-depth interview after transcription, coding and theme identification. In theme 1 (reflective thinking skills), half of the participants admitted that reasoning and decision-making skills should be included into the curriculum of technology; 14(52\%) stressed on empathy and compassion skills to be incorporated; 15(56\%) stressed that ability to planning skills should be integrated; 12 participants viewed compassion as the area to be integrated; 12(44\%) focused on the integrity; and 56\% sees the ability to commitment as the area of transversal skills element that should be integrated into the technology curriculum. These aspects of reflective thinking skills were considered by the experts (Table 1). Therefore, these

findings indicated that reflective thinking skills need to be integrated into the technology curriculum at technical colleges in Nigeria.

In theme 2 (presentation skills), half of the participants admitted that communication skills should be involved into the curriculum of technology; 14(52\%) stressed on media literacy skills to be incorporated; majority sees that information literacy skills to be integrated; 12(44\%) viewed expression of ideas through media as the area to be integrated; and nearly half of the experts focused on the expression of ideas through ICT as the area of transversal skills element that should be integrated into the technology curriculum. These aspects of presentation skills were considered by the participants (Table 1). Therefore, these findings indicated that presentation skills need to be integrated into the technology curriculum at technical colleges in Nigeria.

In theme 3 (resourcefulness skills), half of the participants admitted that to self-discipline should be infused into the curriculum of

technology; 14(52%) stressed on self-motivation to be incorporated; 56% admitted that self-management skills should be integrated; 12(44%) viewed the ability to obtain information through ICT as the area to be integrated; and 12 participants focused on analysis of information through ICT as the area of transversal element that should be integrated into the technology curriculum. These aspects of resourcefulness skills were considered by the respondents (Table 1). Therefore, these findings indicated that resourcefulness skills should be integrated into the technology curriculum at technical colleges in Nigeria.

In theme 4 (application skills), 13(48%) of the participants admitted that ability to enthusiasm and perseverance should be embedded into the curriculum of technology; 14(52%) stressed on conflicts resolution to be incorporated; 15(56%) felt that creativity skills should be integrated; 44% viewed organizing skills as the area to be integrated; 12(44%) focused on application of numeracy; and majority of the respondents sees the ability to application of information technology skills as the area of transversal skills element that need to be

integrated into the technology curriculum. These aspects of the application skills were considered by the respondents (Table 1). Therefore, these findings indicated that application skills should be integrated into the technology curriculum at technical colleges in Nigeria.

1.7 Key Findings of the Study

The key qualitative findings of this research are *Reflective Thinking Skills, Presentation Skills, Resourcefulness Skills and Application Skills*

1.8 Discussion of Findings

On the green skills areas of importance in transversal skills for environmental sustainability, experts agreed on inclusion of reflective thinking, resourcefulness and application skills that involved self-discipline, perseverance, self-motivation and commitment. Report of Asia-Pacific Education Research Institutes Network (ERI-Net) [44] is in congruence with this finding those transversal skills as part of whole development of learners, mostly not taught explicitly in classrooms and not evaluated in traditional exams; it is categorized into

resourcefulness, application skills and reflective thinking. On the same vein, Kemp, Parto [59] and Loorbach [60] pointed out that for long, many countries have made commitments to sustainable development but faced the challenges of appropriate approaches to this; which clearly indicated the need for commitment to that respect. Modebelu, M., & Ugwuanyi, S. (2014) recommended that innate abilities and intelligent skills manifest as self-awareness, self-discipline, and perseverance. Taking all these recommendations together, it is sufficient to note that these areas of transversal skills as identified by this study would play a vital role in the curriculum of technology students.

The findings also revealed that participants stressed on the embedding presentation skills into the technology curriculum which include media and information skills. In this case, UNESCO [61] recommended that campaigning activities of the Decade for Education and Sustainable Development achieved much media attention, schools are slow in integrating scientific, social and environmental problems into mainstream curriculum and pedagogy. This signifies that curriculum review highly needed. More so,

Umar and Khamidi [39] urged that green building awareness depend largely on the public campaign for green buildings; media relations in terms of articles, news release and community relation by providing trade show participation. In line with the above also, Kibert [62] recommended that education and transfer of information across all participants referred to the best method in ensuring that sustainable buildings are erected. For McCoy, O'Brien [35], appropriate content of any curriculum are significant mechanisms for creating a vital information to industry; and stakeholders must ensure their courses gives relevant and vital information to the industry of what is required to elevate the adoption of green building skills. These supporting recommendations made it clearer that these findings in transversal skill will contribute positively in the body of knowledge especially in building construction segment.

1.9 Conclusion

This study explored transversal green skills that are required by technology graduates for environmental sustainability. Important areas of transversal green skills were identified using five categories of respondents/participants made up of

administrators, teachers, craftsmen, instructors and professionals. Conclusively, the findings have some implications on the supervisory agencies toward ensuring that these identified skills are embedded into the curriculum and properly imparted to students before graduation. The findings will be used as a guide to help technology graduates to contribute immensely towards ensuring environmental sustainability.

1.10 Recommendations

Apparently, environmental problems become global issue as they resulted in making sustainable development unachievable in many developing countries. Research evidences indicated that effects of technology were found to be one of the contributing factors to such problems as they were declared as number one green gas emitters and consumes nearly one-third of the total wealth in the world. Government in many countries are using every sector (example: educational, commercial, economic, among others) towards tackling these problems. To achieve success in the fight against environmental sustainability problems, the significant way is to explore transversal green skills into the technology

sectors which are identified as one of the leading factors to such problem with a view to tackling these sustainability challenges.

This study provides a more detailed understanding of the roles of transversal green skills in assuring environmental sustainability by exploring important areas of transversal green skills elements considered as remedy to environmental sustainability. For the effective implementation, the study recommends that policy makers and administrators of education in the world in planning, organization and implementation of technology curriculum in their schools aimed at achieving environmental sustainability.

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