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Building technology training and student work readiness

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ABSTRACT

The purpose of this study is to examine the readiness of Building technology graduates for the construction industry from four selected Polytechnics in Southwestern Nigeria. With a random sampling technique, a sample of 170 Higher National Diploma Building technology graduates was collected to assess their competence areas in readiness for a future in the construction industry. Results were analyzed using descriptive and inferential statistics (Kruskal-Willis H test). The findings of the study revealed that the level of preparedness of Building graduates for the construction industry is encouraging but shows a declining trend in practical capabilities in carrying out building surveys, preparation of site reports and preparation of reliable estimates for materials, labor and cost of construction works. The study results also presented no significant difference ($r>0.05$) in the competency of Building technology graduates based on their institutional training in three competency areas (capability to carry setting out of all kinds of buildings, understanding and interpreting structural drawings, understanding, and interpreting architectural drawings). However, the study also presented a significant difference ($r<0.005$) in seven competency areas of Building technology graduates based on their institutional training. The study recommends curricula restructuring to focus more on practical training and professional collaboration with the industry.

1. Introduction

The construction industry contributes immensely to any nation's economy. It is responsible for providing the needed infrastructure for every sector of the economy to function effectively (Ujene and Odesola, 2019). In order to achieve this infrastructure development, the construction industry should bring together a variety of professionals comprising Architects, Builders, quantity surveyors, and civil, electrical and mechanical engineers, among others, from the project inception to project completion. The roles played by construction professionals and the competency they possess are significant in successfully executing and completing the project (Chidiebere et al., 2017). Consequently, the construction industry seeks competent and qualified products of tertiary institutions to join its workforce to achieve productivity and remain competitive and innovative (CITB, 2016). Therefore, training provided by tertiary institutions is meant to equip students with competencies in hard skills, which are technical knowledge to perform effectively in the job, and soft skills, which are personal and behavioral attributes that will enable students to relate in the workplace (Andrews and Higson, 2008; Matsouka and Mihail, 2016; Nisha and Rajasekaran, 2018). However, construction industry employers have expressed dissatisfaction with the quality of tertiary institutions graduates in Nigeria and other parts of the world (Zavala, 2020; Oviawe et al., 2017). Olusola et al. (2017) and Tudy (2017) asserted that though these graduates are academically qualified, they are ill-prepared for the construction industry because they lack the necessary competencies required to work and succeed in the construction industry. These have negatively impacted the construction industry by not meeting its objectives due to poor project quality, cost, and project overruns (CITB, 2016). To address the competency gaps of graduates entering the construction industry,

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tertiary institutions must assess whether the training provided to students equips them for the industry. One approach to accomplish this is to conduct a graduate self-assessment to establish their degree of readiness for the workplace. The evaluation feedback is critical for training improvements and curriculum creation for institutions (Kibwami et al., 2020) and for identifying competency areas of strength, weakness, and improvement of graduates before entering the world of work. Although studies in the built environment have been carried out to assess students' level of preparedness for the workplace (Akinshipe and Aigbavboa, 2018; Nicholas et al., 2007), however, these studies are unrelated to Building technology students in Polytechnics in Nigeria. The preparedness and competency of Building technology graduates are vital to the Nigerian construction industry in that the building professionals have been given the sole responsibility for executing and managing all building projects including construction craftsmen according to the Nigerian National Building Code (FRN, 2006). In view of this, this study examined the competencies of Building technology fresh graduates from the training acquired in the polytechnic with a view to determining their readiness for the construction industry.

1.1. Construction industry needed skills and competencies

The construction industry's structure is inherently unpredictable and complicated. Because of the construction industry's competitive nature and frequent changes in needs, highly educated and skilled graduates are in great demand to increase efficiency and productivity. Aigbavboa and Aliu (2017) admitted that the skills and competencies are essential in the construction industry to support professionals in handling construction projects in order to achieve timely project completion, productivity, and value for money. To guarantee the success of graduates entering the construction industry, they must possess both hard (technical) and soft (behavioral) skills/competencies. Several studies have outlined skills and competencies needed in the construction industry. These skills and competence areas are highlighted in Table 1.

Table 1: Skills and competencies identified in the literature for the construction industry

Discipline and Citation	Identified skills/competency areas
Building Technology Gimba (2011)	Academic skills, personal management skills, responsibility skills, entrepreneurship skills, teamwork skills, and work ethic skills.
Estate Management Egbenta (2015)	Basic skills, thinking skills, information technology skills, interpersonal skills, resource management skills and personal quality.
Built Environment Aigbavboa and Aliu (2017)	Critical thinking skills, personal skills, workplace skills, academic and management skills, work ethics, business skills, technical and leadership skills.
Architecture Maina and Daful (2017)	Teamwork, competence in oral and written communication, decision making, computer-aided design, ethical commitment to work and colleagues, will and drive to succeed.
Engineering Othman et al. (2017)	practical communication skills, problem-solving skills, interpersonal skills, ability to plan, teamwork, computer literacy skills, personality skills, leadership skills, logical and analytical skills
Quantity surveying Yogeshwaran et al. (2018)	Ethics and professional, computer literacy, measurement and costing practice, leadership and management, construction technology and environmental services.
Building Survey Husain et al. (2020)	Ability to identify, use and handle the latest surveying equipment/tools, Building construction and technology, communication skills, knowledge in building elements, facilities management, building defects, and building material, confidence level, language proficiency, Building pathology, working independently, Building inspection, critical thinking, problem-solving skills, digital construction, and systems.
Construction management Yussof et al. (2021)	Hard skills include project management, construction economy, project evaluation and development, measurement and estimating, project planning, legal study, and building service. Soft skills include interpersonal, problem-solving, teamwork, communication skills, leadership, and critical thinking.
Building Technology Obaju et al. (2022)	Setting out different types of buildings, Interpretation of architectural drawings and specifications, Tendering and contract processes, construction of various building components and Effective communication on the construction site.

As shown in Table 1, various disciplines in the construction industry require some level of competencies for students in that field to function perfectly in construction and the building profession is not an exception.

1.2. Building technology training in polytechnics

The main goal of the Building technology program in Polytechnics is to produce technicians and diplomats who can perform critical functions and actively participate in the construction industry, with a focus on building production management (NBTE, 2001). According to NIOB (2002), Building technology is a multi-disciplinary program that trains students to be technically and managerially competent with entrepreneurial skills to manage building production processes for the benefit and satisfaction of clients and society. The Building Technology program's curriculum allows students to study general courses, foundation courses, and professional courses and undergo the Supervised Industrial Work Experience Scheme (SIWES) to have a workplace experience.

According to Curriculum of Building technology NBTE (2001), Building technology students at the end of the four-year training programme must be competent in the following areas to operate and

succeed in the construction industry; (a) efficient management and supervision of the construction of all sorts of structures from the start to the finish, (b) appreciation and interpreting architectural, structural, and service project designs, as well as putting them into action on the job site, (c) design and preparation of structural drawings for medium-sized buildings, (d) appreciation and determination of material quality for construction through appropriate tests in accordance with relevant codes of practice, (e) Cost, material, and labour estimates for all building works, including maintenance work (f) conducting surveys of existing buildings of various types and preparing a schedule of dilapidation and maintenance and (g) Preparation of cost-effective report for all sizes of building contracts.

Furthermore, upon graduation, Building technology students are expected to become registered professional Builders and specialize in construction technology, building services, building structures and materials, construction management and economics, and building maintenance. Building technology graduates are required to operate in a variety of positions in the construction industry, such as contract manager, project manager, facilities manager, maintenance manager, project management consultant, health and safety officer, and building officer, to name a few (NIOB, 2002; Ogunbiyi, 2015). Given the wide range of career options, Building technology graduates must be prepared with the required abilities to work effectively with other professionals in the construction industry.

2. Methodology

The study utilized quantitative research as the major research tool similar to Nicholas et al. (2007) with a survey questionnaire as the primary research instrument. The quantitative technique, according to Ghani et al. (2020), entails acquiring numerical data and analyzing it using a mathematical method. The study began by collecting graduated students' data from the four top-ranked Polytechnics in Southwestern Nigeria following National Board for Technical Education in 2019 ranking. The information obtained was used to build up the population for the study, comprising Yaba College of Technology, Lagos State (YabaTech), Federal Polytechnic Ilaro, Ogun State (FPI), Federal Polytechnic Ede, Osun State (FPE), and The Polytechnic Ibadan, Oyo State (PI). Following this, a questionnaire survey was used to obtain data for the study. The survey questionnaire was designed to be easy to understand and was made up of two sections: the first section contained basic information on the respondents such as gender, year of experience, and field while the second section sought to assess the ability to build graduates based on their training in building technology. The identified skills and competencies from the literature (Table 1) for the construction industry were measured on a 5-point Likert scale, 1=Not Competent; 2=Less Competent; 3= Moderately competent; 4=Competent, and 5=Very Competent. The nature of this study involved surveying building students' competence upon graduation from the polytechnic programs. As such, a random sampling technique was considered to be more appropriate for the study since it allows each element of the population an equal opportunity of being included in the sample (Taherdoost, 2016). A total of 487 students were identified, out of which 170 were adjudged to meet the requirements for the study. These were HND building technology who graduated between 2020 and 2021. A total of 126 survey questionnaires were duly completed and returned out of which 124 were found valid for analysis. The collected data were analyzed using descriptive statistics, including frequency distribution, percentages and mean item score (MIS) while the inferential statistics analysis was carried out using the Kruskal-Willis H test for the competency of building graduates based on their institutional training.

3. Results and discussion

One hundred and seventy (170) questionnaires were distributed to HND building technology graduates in selected polytechnics in Southwestern Nigeria. One hundred and twenty-four (124) questionnaires were returned, representing a 73 percent response rate. Table 2 presents the profiles of Building graduates according to their institutions.

Table 2: Building technology graduates' profile

Institutions	Sample size	Respondents	Percentage
Yabatech	42	24	19.4
FPI	33	23	18.5
FPE	45	41	33.1
PI	50	36	29.0
Total	170	124	100

From the profile of the respondents presented in Table 2, Federal Polytechnic Ede (FPE) has the greatest number of respondents (41), accounting for 33.1 percent of the entire response. On the other hand, Federal Polytechnic Ilaro (FPI) accounted for the lowest number of respondents (23), representing 18.5 percent of the responses.

3.1. Competency of building technology graduates from polytechnic training

The essence of training in tertiary institutions is to prepare students for the workplace, imbibing in them some skills and competencies that will help them be employable and succeed in the workplace.

Building technology students must obtain some degree of competency at the end of the four-year Polytechnic training program to facilitate their transition and success in the construction industry. Table 3 shows the competencies acquired from the training in Building technology as ranked by Building technology graduates in four Polytechnics. From the result, the most significant competencies acquired by Building graduates are understanding and interpreting architectural drawings, the capability to carry out setting-out of all kinds of buildings, the capability to manage and supervise the construction of buildings of different sizes efficiently and understanding and interpreting structural drawings with means values of 4.58, 4.52, 4.44 and 4.44 and respectively.

The understanding and the ability to interpret architectural drawings is a vital competency needed by Building students for the construction industry. This competency is to translate the drawings into physical structures. These findings align with studies by Gimba (2011), Awere et al. (2016), and Obaju et al. (2022) that the ability to interpret architectural drawings is one of the most crucial competencies and employability skills for building technology graduates. This competency area is critical to the Building professional because it will enable them to determine whether the building is buildable in reality or not. It will also help detect errors or omissions in the drawings before the actual construction work commences. This competency area will also assist the builder in preparing the construction project methodology and program, health, and safety plan, and project quality plan (Ogunbiyi, 2015). Another competency acquired by Building graduates in preparation for the construction industry is the capability to set out all kinds of buildings. These findings agree with Osuizugbo's (2020) study that for a builder to perform effectively in the role of project supervisor in construction projects, the builder must be able to set out different kinds of buildings. This competency is vital in the construction process to accurately transfer the building design or drawing to the ground and ensure the building is constructed within its boundary. In addition, competency in setting out the building foundation requires well-trained and competent individuals to carry out the procedure because the process determines the structural stability and orientation of the building as well as establishing the positions of columns and walls in the building.

The capability to efficiently manage and supervise the construction of buildings of different sizes is a key competency for every building graduate because it is one of the core duties of the Building profession, as mentioned in the FRN (2006). Ujene and Odesola (2019) also emphasized the significance of supervisory competencies for Building graduates, stating that it affects the productivity of construction workers and craftsmen as well as the ultimate output of a building project. This expertise in construction process management and supervision will guarantee that all resources are used effectively and efficiently during the building process.

Table 3: Competency of building technology graduates from polytechnic training

Expected Competencies from Training	Yabatech		FPI		FPE		PI		Overall	
	MS	Rank	MS	Rank	MS	Rank	MS	Rank	MS	Rank
Understanding and interpreting architectural drawings	4.57	1st	4.44	4th	4.54	1st	4.87	1st	4.58	1st
Capability to carry out setting-out of all kinds of building	4.43	3rd	4.75	1st	4.22	2nd	4.79	3rd	4.52	2nd
Capability to manage and supervise the construction of buildings of different sizes efficiently	4.57	1st	4.64	2nd	4.05	4th	4.71	4th	4.44	3rd
Understanding and interpreting structural drawings	4.52	2nd	4.47	3rd	4.12	3rd	4.83	2nd	4.44	3rd
Capability to comprehend and interpret different types of services drawings to be executed on-site	4.35	4th	4.39	7th	3.98	5th	4.71	4th	4.31	4th
Capability to design and prepare structural working drawings for medium size building structure	4.35	4th	4.06	5th	3.73	8th	4.54	7th	4.10	5th
Capability to test and determine materials quality for construction	4.04	6th	3.86	6th	3.90	6th	4.71	4th	4.07	6th
Capability to prepare practicable estimates in terms of material, costs and labor, including maintenance work	4.22	5th	3.78	8th	3.83	7th	4.58	8th	4.03	7th
Capacity to prepare site reports during construction works	3.74	7th	3.42	9th	3.73	9th	4.62	5th	3.81	8th
Capability to carry out a building survey for all kinds of buildings	3.96	9th	3.31	10th	3.56	10th	4.54	7th	3.75	9th

Although it is the responsibility of structural engineers to design the structural components of buildings, building technology graduates must be able to evaluate structural drawings to establish the structural stability of the construction and spot flaws, contradictions, and omissions in the design as part of their duty to determine the structure's build ability. Understanding and interpreting structural drawings are crucial in construction since poor structural design has been recognized as one of the most common causes of building failure and collapse (Almarwe, 2017).

On the other hand, the study indicated the least competent areas identified by the respondents. One

of these is the capability to carry out surveys of all kinds of Buildings. This finding affirms the studies of Dahiru and Okotie (2010) that most tertiary institutions do not adequately train their students in building surveying. Building surveying competency is vital for the building graduate because building surveying is one of the professional areas of practice critical in investigating and preparing documents for building repairs, renovation, and improvement (Ogunbiyi, 2015). This finding, therefore, suggests that graduates joining the construction industry are unlikely to be able to recognize and report defects, as well as carry out maintenance work in building facilities. Another least competent area of training identified by the respondents in the study is the capability to prepare site reports during construction activities. A related study by Aliu and Aigbavboa (2019) found that built environment graduates are deficient in communication skills, most especially writing skills. This competency area is key to the performance of Building graduates as project managers on construction sites because it entails providing vital information about the activities on-site, monitoring project progress, and identifying likely risks to the successful completion of the project. This finding, therefore, implies that graduates entering the construction industry will be unable to properly communicate project activities, performance, challenges, and improvements to other project stakeholders.

Another area where Building graduates are less competent in the study is preparing practicable estimates for cost, labor, and materials for construction works. These findings corroborated Regmi and Willis's (2018) study, which found that the construction sector had trouble effectively estimating construction projects. As a result, erroneous estimates substantially impact the success of construction projects, resulting in cost overruns, disputes, and claims on construction projects (Awosina et al., 2018; Sitanggang et al., 2019).

3.2. Kruskal-Willis H test analysis

To determine whether there is a significant difference in the competency of Building technology graduates across the four institutions, the Kruskal-Willis H Test was performed. As clear in Table 4, the Kruskal–Wallis coefficient shows seven areas where significant differences in the competency of Building graduates were observed. Specifically, the capability to manage and supervise the construction of buildings of different sizes efficiently, the capability to comprehend and interpret different types of services drawings to be executed on-site, the capability to design and prepare structural working drawings for medium size building structures, the capability to prepare practicable estimates in terms of material, costs and labor, including maintenance work, capability to test and determine materials quality for construction, capability to carry out a building survey of all kinds of Buildings and capability to prepare site report during construction works resulting in $p<0.05$. This finding implies that the type of training obtained from various institutions influences the competency and preparedness of Building graduates for the construction industry. This finding is consistent with the findings of Afolabi et al. (2019), who discovered that the level of competency of Building students is attributed to the institutions' teaching and training qualities and the students' level of exposure to the construction industry through student work experience programs. Also, the students' levels of learning in the long run play a vital role in their competency as construction manager in the construction industry (Mohammad et al., 2017)

Table 4: Kruskal-Willis H test of difference in the competency of building graduates by institutions

	Kruskal-Willis H	df	Asymp. Sig
Capability to carry out setting-out of all kinds of Building	9.532	3	.023
Capability to manage and supervise the construction of buildings of different sizes efficiently	15.700	3	.001
Capability to understand and interpret structural drawings	11.947	3	.008
Understanding and interpreting architectural drawings	8.619	3	.035
Capability to comprehend and interpret different types of services drawings to be executed on-site	14.141	3	.003
Capability to design and prepare structural working drawings for medium size building structure	14.949	3	.002
Capability to prepare practicable estimates in terms of material, costs, and labor, including maintenance work	18.320	3	.000
Capability to test and determine materials quality for construction	23.896	3	.000
Capability to carry out a building survey of all kinds of Buildings	27.220	3	.000
Capability to prepare site reports during construction works	26.361	3	.000

4. Conclusion

The complexities of the construction industry necessitate competent and industry-ready graduates to fulfill its aims and objectives. Hence, students in built environment-related programs must be equipped to satisfy these expectations. Tertiary institutions, on their part, must provide appropriate training to guarantee their graduates' seamless entry and success in the construction industry. Based on the training obtained at various Polytechnics, this study examined the readiness of fresh Polytechnic Building graduates for the construction industry. The study's outcomes show that the level of readiness of Building graduates for the construction industry is encouraging.

Nevertheless, considerable effort must be made to increase their competency in construction project report writing, building surveying, and preparation of estimates of construction projects. These can be

achieved by redesigning the Building Technology curriculum to make it more practically oriented and less theoretical in orientation. Students should frequently visit construction sites to bridge the gap between classroom learning and real-world construction experience; It will help students better comprehend construction procedures and activities. Institutions must also collaborate with construction industry professionals to exchange knowledge and teach students in practically oriented courses to boast students' competency in readiness for the construction industry.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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