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OFFSITE CONSTRUCTION SKILL NEEDS OF BLOCK-LAYING AND CONCRETING STUDENTS FOR OPTIMAL PRODUCTIVITY AND SUSTAINABILITY IN COVID-19 ERA IN RIVERS STATE

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Abstract

The aim of the study is to determine the offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State. The study was guided by one research question and one hypothesis. The research method adopted was a descriptive survey research design. The population of the study consisted of seventy-five industrial supervisors and 15 block-laying and concreting teachers in the technical colleges in Rivers State. The entire population were used for the study considering the manageable size. A structured five point Likert scale questionnaire titled Offsite Construction Skill Needs in Block-Laying and Concreting for Optimal Productivity and Sustainability in Covid-19 Era in Rivers State (OCSNBCPSCERS) was developed to elicit responses from the respondents. The validity of the instrument was carried out by three lecturers in the department of Industrial Technical Education who carried out a face and content validity of the questionnaire items. The reliability of the instrument was determined by administering copies of the instrument to five block-laying and concreting teachers in Federal Science and Technical College Ahoada and ten builders who were not part of the sample used for the study. Thereafter, the internal consistency of the instrument was determined using Cronbach Alpha reliability coefficient and a reliability coefficient .89 was obtained indicating that the instrument was highly reliable. The research question was answered using mean while an independent sample t-test was used to test the null hypothesis at .05 level of significance. For answering the research question, a criterion mean of 3.50 was established. Mean responses of 3.50 and above were needed while mean responses below 3.50 were not needed. For testing the hypothesis, when the calculated t-value is below the critical table value the null hypothesis was accepted otherwise the hypothesis is rejected. The study revealed that the ability to read and interpret working drawings, operate mechanical equipment, hoist, assemble and erect components, prepare and apply non shrink mortars to seal gap, adjust the panel in position and secure, ensure joint widths are consistent before grouting, set up formwork for casting joints are the skills needed for offsite construction. Finally, the researchers recommended that block-laying and concreting teachers should be retained on the various offsite construction techniques and materials. The National Board or Technical Education (NBTE) should review the block-laying and concreting curriculum and include offsite construction methods as part of the current trends in the construction industries for optimal productivity and sustainability.

Keywords: Offsite construction, block-laying and concreting, productivity, sustainability, covid-19 era.

Introduction

As an important aspect of Technical Vocational Education and Training (TVET), block/block-laying and concreting leads to the learning of skills and procedures that allow a person to make a livelihood. In technical colleges, block/bricklaying and concreting are taught at both the intermediate and advanced levels. In addition to subjects such as mathematics, English language, physics, chemistry, social studies, and so on, the intermediate block-laying and concreting curriculum includes core trade subjects such as Introduction to Building Construction, Concreting, Blocklaying, Bricklaying, Land Surveying, Quantity Surveying, Technical Drawing, Building Drawing, and Construction Management (Kennedy, 2012). Block/bricklaying and concreting is a vocational course taught in Nigerian technical institutes with the goal of gaining theoretical and practical expertise in building construction. The trade course is designed to create the groundwork for technical and vocational artisans who want to pursue further education. Bricklaying and concreting, like all other courses, are taught in classrooms and workshops, with each subject complementing the others. At the technical college level, block/bricklaying and concreting was formed to offer students with the essential knowledge and methods to allow them to perform successfully in all elements of block work in the construction sector. Students should be able to use a variety of tools and equipment in the bricklaying and concreting profession after completing the program. Carpentry and joinery, painting and decoration, building drawing, manual construction and mortar mixing, moulding of blocks, laying of blocks, plastering and rendering of walls, walls and floor tilling, pointing and jointing top walls, and laying of curved walls are all skills required for block/brick laying and concreting. It also entails concrete workability testing (slump test), concrete placement, admixture application, compaction, concrete curing, and concrete joint material fixing (Ayonmike & Okeke, 2015). Students are also taught how to conduct concrete workability tests, slump tests, place concrete, work with admixtures, compact new concrete, cure concrete, and install concrete joint materials, among other things (David & Jude, 2017; Federal Republic of Nigeria, 2013). The nature of bricklaying and concrete operations training is focused on genuine work operations rather than fictitious activities. This implies that students should be educated to the point that they are capable of obtaining and maintaining job, as well as profiting from it. In order to do this, proper teaching, training facilities, and skills must be used throughout the instructional process. Seventy percent (70%) of the instruction provided at technical institutes is practical, whereas 30% is theoretical. After completing the program, block-laying and concreting students will be trained and self-sufficient craftsmen capable of efficiently executing and organizing Block-laying and Concreting operations in a building project with high level of productivity.

Productivity is commonly defined as a ratio between the output volume and the volume of inputs (Paula, Sanna, Juhani & Helina, 2014). In construction, productivity is usually taken to mean labor productivity, that is, units of work placed or produced per man-hour. It is involves the physical progress achieved per person hour, per person hour linear metre of conduit laid or person hour cubic metre of concrete poured (Paul, & Ammar, 2004). According to Barnes, Soames, Li, and Munoz, (2013) productivity measures how efficiently production inputs, such as labour and capital, are being used in an economy to produce a given level of output. For the success of any organization or construction projects it is important to compare actual productivity to optimal productivity. Optimal productivity is the highest sustainable productivity level that can be achieved under "good management" and "typical field conditions". Productivity is considered a key source of economic growth and competitiveness and, as such, is basic statistical information for many international comparisons and country performance assessments. The two most important measures of labour productivity are the effectiveness with which labour is used in the construction process and the relative efficiency of labour doing what it is required to do at a given time and place. Productivity in

construction industries leads to the increase of projects being completed more quickly; reduced project abandonment, submission of more competitive bids by contractors; and profit maximization in construction projects. In as much as productivity should be increased, sustainable construction should not be undermined.

Sustainable construction has recently gotten a lot of press. Meeting our own needs without jeopardizing future generations' capacity to fulfill their own needs is what sustainability entails (Anupam, Takanori, Takashi and Tohru, 2009). During civilization, people need a large number of structures in order to survive. During their construction, operation, maintenance, and demolition, these plants create a slew of environmental issues. Buildings, according to Mustafa and Adem (2015), use a large amount of energy and natural resources and contribute to climate change through influencing the quality of air and water in cities. According to Dixon (2010) buildings utilize 45 percent of global energy and 50 percent of global water supply and are responsible for 23% of air pollution, 50% of greenhouse gas output, 40% of water pollution, and 40% of solid waste in cities. Changes in the applications may significantly reduce the environmental issues generated by the building sector. The construction industry's intensive use of natural resources, solid and liquid wastes, and gas emissions at the conclusion of construction and demolition operations all have a significant detrimental influence on the environment. Vyas, Ahmed and Parasher (2014) noted that consumption of non-renewable resources, loss of biological variety, destruction of forest regions, loss of agricultural areas, air, water, and soil pollution, destruction of natural green spaces, and global warming are just a few of the negative consequences. The main objective of sustainable construction is to lessen environmental effect, reduce energy usage and trash generated. This can be achieved by the use of renewable and recyclable materials. Sustainable construction should not cease when the structure is finished; rather, the project should have a lower environmental effect during its lifetime. This means that features in the building design should have a long-term beneficial effect on the building's environmental impact. These may include adequate insulation to avoid heat loss, solar panels to decrease energy usage, and reusable construction materials. With the onset of the Covid-19 pandemic caused by the transmission of coronavirus, the health and safety of construction workers has been strongly questioned.

Coronaviruses are a group of viruses that infect both animals and humans and belong to the Coronaviridae family. MERS (Middle East Respiratory Syndrome) and SARS (Severe Acute Respiratory Syndrome) are types of human coronaviruses that produce mild disease akin to a common cold, while others cause more severe disease (such as MERS and SARS). In December 2019, a novel coronavirus that had not previously been detected in humans was discovered in Wuhan, China (Seyed and Mirzapour 2021). The World Health Organization (WHO) declared the outbreak a pandemic on March 11, 2020, affecting approximately 12 million individuals in multiple nations since it was first identified. Unless there are additional comorbidities or prior conditions, the disease is usually mild. Rutu, and Yadav et al (2020) classified the COVID-19 transmission as direct and indirect. Transmission through aerosols formed during surgical and dental operations and/or in the form of respiratory droplet nuclei; bodily fluids and secretions, such as feces, saliva, urine, semen, and tears; and mother-to-child transmission are all examples of the direct route. SARS-CoV-2 is thought to transmit mostly by respiratory droplets created by an infected person's talking, coughing, and sneezing. If the infected individual is within one meter of a vulnerable host, the exposure and hence the probability of transmission is enhanced. The virus is transmitted from sites other than the respiratory system by a smaller percentage of infected persons. While the danger of transmission by mechanisms other than the respiratory system is low, it is nonetheless conceivable. Indirect transmission may happen via fomites or surfaces like furniture and

fixtures in an infected patient's immediate surroundings, as well as things used on the sick person. Several of these modalities may be overlooked, resulting in greater viral propagation (Cai & He et al., 2020).

Many vaccines have been created successfully by the medical industry. Despite the different vaccinations that have been produced, covid-19 instances have resurfaced over the world. SARS-CoV-2, the virus that causes covid-19, has evolved over time as have other viruses. When a virus replicates or duplicates itself, it sometimes alters somewhat, which is natural for a virus. Mutations are the term for these alterations. A variation of the original virus is a virus that has one or more additional mutations (WHO, 2020). The Nigeria Centre for Disease Control (2021) exerted that all viruses, including SARS-CoV-2, the virus that causes covid-19 disease, gradually evolve over time (COVID-19). Thousands of mutations have evolved and will continue to develop since SARS-CoV-2 was originally discovered, enabling new strain lineages of the virus to emerge. The great majority of mutations have minimal influence, but in rare circumstances, a virus may evolve in such a manner that it will survive and reproduce well than its parents. Viruses containing these mutations may then become more common as a result of natural selection. Variants of concern are mutant viruses that have a competitive advantage. Faster or more efficient transmission, increased risk of severe disease or death, escape immunity from previous infection, escape immunity from vaccination, or evasion of detection by existing tests are all advantages conferred by these mutations, which lead to the classification of "new variants" as "variants of concern." The health and safety of construction workers is a top priority, given the mechanisms of transmission and the advent of the numerous covid-19 mutations. As a result, in the Covid-19 age, there is a need for innovation in the way constructions are carried out in Rivers State and Nigeria as a whole, in order to preserve the needed social and physical distance, hence limiting the spread of the Covid-19 pandemic.

The design and implementation of new processes, products, services, and delivery systems that result in substantial improvements in results, efficiency, effectiveness, or quality, as well as the successful exploitation of new or borrowed ideas from other industries or organizations is referred to as innovation (Mulgary & Albury, 2003; National Audit Office 2009; Taylor, 2017). Offsite construction is one of the much innovation in the building construction industry. Traditional construction involves the onsite erection of structures using cast in-situ reinforced concrete and the delivery of materials to be employed in a step-by-step onsite construction process, as opposed to off-site construction, which involves factory fabrication and site assembly of buildings (Abanda, Tah & Cheung 2017). Industrialization and the rising movement of formerly onsite construction activities to offsite factory-based prefabrication will have a significant impact on the present status of offsite building in the future (Ginigaddara & Perea et al., 2019). As a result, onsite labor will be limited to the assembly of structures or building components, which will be carried out by sophisticated self-directed work package gangs (Goulding, et al., 2014). In this respect, the proportion of onsite to offsite construction varies based on the kind of offsite construction used in the project. Similarly, the need for experienced employees and specialists both on and offsite varies depending on the nature of offsite construction (Southern, 2016). Prefabrication is used in off-site construction. The act of gathering segments of a structure in a manufacturing process or other assembly site and transferring entire congregations or sub-gatherings to the development site where the structure is to be developed is known as prefabrication in construction (Baghchesaraei, Meltem, & Baghchesaraei, 2015). The name is used to distinguish this operation from the more common construction routine of bringing the necessary supplies to the building site, where everything is put together. Prefabrication is a phrase used in the construction industry to describe assemblies that are produced at a

processing plant and then delivered to construction sites for assembly into buildings and structural works. Prefabricated structure segments are made from a variety of materials, such as steel, concrete, reinforced concrete, wood, aluminum composites, and plastics, at particular development facilities or on-site yards.

Statement of Problem

The construction business is one of the most labor-intensive industries in the world. Building projects show a greater dependence on construction labor. Despite this, studies show that labor is only employed to 40-60% of its optimal efficiency, and that up to 50% of labor costs are wasted owing to inadequate workforce and crew management methods (Santhosh, Perry, Satyanarayana, 2018). The covid-19 pandemic has continued to pose a serious hazard to construction workers' health and safety. The World Health Organization has suggested a physical and social separation of two meters to avoid the spread of covid-19, which is nearly hard to achieve using onsite building procedures. In addition, despite multiple vaccinations Covid-19 instances have resurfaced over the world (The Nigeria Centre for Disease Control 2021). In view of the above stated problems there is need to impart the current method of construction on block-laying and concreting students. Thus the researchers sought to assess the offsite construction skill needs of block-laying and concreting students for maximum productivity and sustainability.

Aims/ objectives of the study

The aim of the study is to determine the offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State.

Research Question

What are the offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State?

Research Hypothesis

Significant difference does not exist between the mean scores of teachers and industrial supervisors on the offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State.

Research Methodology

The research adopted a descriptive survey research design. This design was appropriate for the research because survey design according to Ogundu (2018) is a type of descriptive survey research whose purpose is to collect data from a large or manageable sample of a population so as to determine the distribution, occurrence and interaction of educational and sociological phenomena. In this design the researcher obtained responses from the population. The population of the study consisted of seventy-five industrials supervisors and 15 block-laying and concreting teachers in the technical colleges in Rivers State. The entire population were used for the study considering the manageable size. A structured five point Likert scale questionnaire titled Offsite Construction Skill Needs in Block-Laying and Concreting for Optimal Productivity and Sustainability in Covid-19 Era in Rivers State (OCSNBCPSCERS) was developed to elicit responses from the respondents. The validity of the instrument was carried out by three lecturers in the department of Industrial Technical Education who carried out a face and content validity of the questionnaire items. Their suggestions and corrections were incorporated in the drafting of the final copy of the instrument that was issued to the respondents. The reliability of the instrument was determined by administering copies of the instrument to five block-laying and concreting teachers in Federal Science and Technical College Ahoada and ten builders who were not part of the sample used for the study. Thereafter, the internal consistency of the instrument

was determined using Cronbach Alpha reliability coefficient and a reliability coefficient .89 was obtained indicating that the instrument was highly reliable. The research question was answered using mean while an independent sample t-test was used to test the null hypothesis at .05 level of significance. For answering the research question, a criterion mean of 3.50 was established. Mean responses of 3.50 and above were required while mean responses below 3.50 were not required. For testing the hypothesis, when the calculated t-value is below the critical table value the null hypothesis was accepted otherwise the hypothesis is rejected.

Data Presentation

Research Question 1: What are offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State?

Table 1: Means Score of Teachers and Industrial Supervisors On offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State

S/N	Items	Teachers			Industrial Supervisors		
		$\bar{x}$	SD	RMK	$\bar{x}$	SD	RMK
1)	Read and interpret working drawings	4.33	.49	N	4.38	.49	N
2)	Operate mechanical equipment	4.25	.45	N	4.66	.48	N
3)	Hoist, assemble and erect components	4.67	.49	N	4.52	.50	N
4)	Prepare and apply non shrink mortars to seal gap	4.75	.45	N	4.40	.50	N
5)	Adjust the panel in position and secure	4.58	.52	N	4.50	.51	N
6)	Ensure joint widths are consistent before grouting.	4.08	.29	N	4.50	.51	N
7)	Set up formwork for casting joints	4.58	.52	N	4.28	.54	N
8)	Set reference line / offset line to required alignment and level of slab / beam during installation	4.42	.52	N	4.72	.45	N
9)	Install temporary props to support slab or beam	4.33	.49	N	4.50	.51	N
10)	Lift and rig the elements to designated location	4.52	.52	N	4.50	.51	N
11)	Align and check the level before placement	4.67	.49	N	4.52	.51	N
12)	Create 3D and 4D models	4.08	.29	N	4.50	.51	N
13)	Estimate the quantity of materials required	4.67	.49	N	4.34	.59	N
14)	Plan and coordinate delivery of materials in construction sites	4.75	.45	N	4.50	.50	N

15)	Carry out accurate measurements	4.42	.52	N	4.50	.51	N
	Grand Mean	4.47	0.47		4.49	0.51	

Source: Field Survey 2021

Table 1 shows the mean scores of teachers and industrial supervisors on offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State. The respondents agreed on all the items in the instrument. The mean score of the respondents ranged from 4.25 to 4.75 which exceeded the criterion mean of 3.50 thus indicating that all the items in Table 1 are the skill needsof block laying and concreting students for offsite construction for optimal productivity and sustainability in covid-19 era in Rivers State.

Research Hypothesis: Significant difference does not exist between the mean scores of teachers and industrial supervisors on the offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State

Table 2: Independent Sample T-test on the mean scores between Teachers and Industrial Supervisors on the Offsite Construction Skill Needs of Block-Laying and Concreting Students for Optimal Productivity and Sustainability in Covid-19 Era in Rivers State

Respondents	NO	$\bar{x}$	**SD**	Df	T-crit	T-calc	P	Decision
Teachers	15	4.47	.47					
Supervisors	75	4.49	.51	88	2.00	.103	.05	Accept

Source: Field Survey 2021

Table 2 is the result of an independent sample T test on the mean scores between teachers and industrial supervisors on the offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State. The mean of teachers obtained is 4.47 and the standard deviation is .47. The mean and standard deviation for supervisors are 4.49 and .51 respectively and a degree of freedom 88. The calculated T value .103 exceeded the critical table value of 2.00 at the .05 level of significance. Thus the null hypothesis was accepted indicating that significant difference does not exist between the mean score of teachers and industrials supervisors on the offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State.

Discussion of Findings

Based on the data gathered from the respondents, the study revealed that the ability to read and interpret working drawings, operate mechanical equipment, hoist, assemble and erect components, prepare and apply non shrink mortars to seal gap, adjust the panel in position and secure, check joint widths are consistent before grouting, set up formwork for casting joints, set reference line / offset line to required alignment and level of slab / beam during installation, install temporary props to support slab or beam, lift and rig the elements to designated location align and check the level before placement, create 3D and 4D models, estimate the quantity of materials required, plan and coordinate delivery of materials in construction sites, carry out accurate measurements are skill needs of block-laying and concreting students for carrying out offsite constructions. The findings of the study is in harmony with Ginigaddara and Perera et al, (2019) and Southern, 2016 who also identified hoisting, assembly and erection of components, sequencing, joinery, crane work and dogging, finishing trade, logistics handling and standardized sub-assembly, multi-skills through job

rotation trade oriented learning, modern industry skills such as double handling of material, operating various machines as the skills required for offsite construction.

Summary and Conclusion

Due to the labour intensive nature of the construction industries, and the large amount of natural resources used in the construction of buildings as well as the spread of covid-19 pandemic which continues to threaten the health and safety of construction workers, there is need to train the block-laying and concreting students on offsite construction techniques. Thus the researchers sought to determine the offsite construction skill needs of block-laying and concreting students for optimal productivity and sustainability in covid-19 era in Rivers State. Based on the data gathered it was concluded that the ability to read and interpret working drawings, operate mechanical equipment, hoist, assemble and erect components, prepare and apply non shrink mortars to seal gap, adjust the panel in position and secure, check joint widths are consistent before grouting, set up formwork for casting joints are the skills required for offsite construction.

Recommendations

Based on the data gathered and analysed, the following recommendations were made:

1) The block-laying and concreting teachers should be retrained on the various offsite construction techniques and materials
2) The National Board or Technical Education (NBTE) should review the block-laying and concreting curriculum and include offsite construction methods to be part of current trends in the construction industries for optimal productivity and sustainability.

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