Development of Work Based Learning Guide for Industrial Training of Carpentry and Joinery Students In Computer Aided Design (CAD) In Technical Colleges In South-South

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Abstract

The aim of this study is to develop a work based learning guide for industrial training of carpentry and joinery students in computer aided design (CAD) in technical colleges in South-South. One researcher question was posed to guide the study. The study was guided by one null hypothesis and was tested at .05 level of significance. The research design adopted for the study was Research and Development (R&D). This design was appropriate because the findings of the study is utilized in designing and developing new programme, materials, which will provide knowledge and skills. Two Structured 5 Point Likert Scale Questionnaire titled Determination of Goals for Work-Based Learning Guide for Industrial Training of Carpentry and Joinery Students in (DGWBLGITCJS) and Computer Aided Design (CAD) Skills Appropriate for Inclusion in Work-Based Learning Guide for Industrial Training of Carpentry and Joinery Students Technical Colleges in South-South (CADSAIWBLGITCJSTCSS) were developed for the study. The various instruments were validated by three experts comprising, one industry supervisor from Rivers State one industry supervisor from Bayalsa and one lecturer in the department of Industrial Technical Education, Ignatius Ajuru University of Education Port Harcourt. Validates carried out both face and content validity. They assessed the whole draft, deleted and added appropriate words and make general comments for the improvement of the Work Based Learning Guide. The internal consistencies of the instrument was determined using Cronbach Alpha method. The questionnaire was distributed to fifteen respondents, comprising eighteen instructors and teachers teaching carpentry and joinery and five industry based supervisors which yielded a reliability of .88 and .83 indicating that the instruments were highly reliable. The work base learning guide was developed by the researcher after carrying need assessment through the administration of questionnaires to experts in the field of carpentry and joining. After the final copy was developed, a month try-out was conducted using 50 technical college students in carpentry and joinery. The trainer was given one week to under study the learning guide. The population of the study consisted of three hundred (300) industry based supervisors, forty instructors and eighty carpentry and joinery teachers amounting to a total of four hundred and twenty (420) respondents. Simple random sampling techniques used to determine the number of the industry based supervisors was determined using simple random sampling technique. Thereafter Yarrow Yemens formula was applied on the number of supervisors which yielded a sample size of one hundred and seventy (170) respondents and the entire population of one hundred and twenty (120) teachers was used for the study. Therefore the total sample size for the study consisted of two hundred of ninety respondents (290). Two hundred and ninety copies of the questionnaire were administered on respondents in South-South with the help of two Research Assistants. The mean and standard deviation was employed in analysing all the various instruments used for the study. The decision for the research questions were based on cut-off point of 3.5. In other words, any item with mean 3.5 and above was considered as appropriate and was accepted. While any mean below 3.5. was taken as inappropriate and not be accepted. An independent t-test was used to test the hypothesis at .05 level of significance. To test the hypothesis. When the calculated the t value exceeded the table the null hypothesis was rejected however when the calculated t value is less than the table value the null hypothesis was accepted. The findings revealed working with 3D plane, creating blocks in drawing, mirroring a drawing, use of short cuts command, placing light in a drawing, attaching materials in a drawing, creating 2D drawing from 3D produce solid model and son on are skills appropriate for inclusion for work based learning guide. Finally, the study recommended that The Industrial Training Fund (ITF) should ensure that the work-based learning guide be made available to all carpentry and joinery students in SIWES as wells their industry based supervisors.

Introduction

Technical colleges in Nigeria are the institutions that provide technical and vocational education at secondary school level. Technical colleges provides intensive vocational education or technical skills required for a particular job. At the technical colleges, students are trained on several of trades such as welding and fabrication, plumbing and pipe fitting, painting, tiling, motor vehicle repair and maintenance, electrical installations and electronic repair and maintenance, carpentry and joinery amongst others (Ogundu, 2017, Ali 2015).

Carpentry and Joinery are two professions in one, it is merged together because the two professions work hand in hand and can be acquired by an individual who is popularly referred to as a carpenter. Professionally, there is a carpenter and a joiner, but significantly the two of them works with wood and their major function is to treat and fashion wood to a product which usually is used in buildings and other construction works. Joiners as those who join woods to form an object, whereas carpenters are those who construct building elements on site and uses the woods joined by joiners to accomplish their tasks. Furthermore, he graded their job as thus; joiners jobs include making doors/windows frames, creating fitted furniture and building stairs, while the carpenters jobs include fitting floors, fitting staircases, fixing window frames and installing cupboards and shelving. The two professions are most times inseparable because mistake from one must affect the other, also there are some overlaps as most carpenters and joiners will have to learn the basic trades before specializing, the joiner makes the product that the carpenters install or repair. Therefore, it is eminent and more convenient for an individual to carry out the two to ensure efficiency and accuracy, hence the combination to bear Carpentry and Joinery as its nomenclature at the technical college level and the professionals are popularly referred to as Carpenters. Saint-Gabain (2015) and Youth (2020) listed six basic trades in carpentry and joinery and the activities obtainable under each trade as; bench work/ bench, site work/site carpenters, shoplitting/fitters, timber frame erection/formwork, wheel wrighting and Computer aided design (CAD).

The construction industry is highly dynamic. The emergence of new technologies has greatly influence the work force. For example designs were made with paper and pencil however current practice is to design with the aid of computer. (Taiwo, 2017; Orji & Uka, 2020). Computer aided design (CAD) refers to the use of computer software for design. Computer aided design (CAD) according to Zhu (2017) is the use of computer and its graphics equipment to help designers to design a work. Zhu further stated that computer aided design is a kind of auxiliary design, which uses the computer as the medium, instead of the brush, to express the design content and make it more vivid and comprehensive. Computer aided design has almost taken over traditional drawing/designs, that is why design has moved from studio room to computer-aided design studio or "paper-less studio" as it is sometimes called. Computer aided design skills are what determine how well carpentry and joinery students communicate effectively with clients, employers, cooperate in a team, stay organized and use creativity. Teaching computer aided design has been popularized in all fields of engineering design and has occupied a more important position. Its continued rapid development can prove the important role of computer aided design in engineering design. With computer aided design software, the design effect of the designer can be more and more effective (Shen, 2009). CAD saves time, makes the creation of design quick and fast, CAD is more accurate than drawing

with manually with hence mistakes in design are highly reduced. In addition, a single document can be printed in different forms for many users, documents are easily reproduced and cloned and it enables visualization of complex designs. Doukpola (2021) furthers explained that CAD allows designers to rotate designed components and assembly system in 3-D dimensional environments and let users view designed products from different angle to ease the design process. To be competent in computer aided design CA, it is important for carpentry and joinery students to taught CAD when they embark on students industrial work experience scheme (SIWES)

Students Industrial Work Experience Scheme is a skill development program designed to prepare students for transition from the college environment to work (Akerejola, 2008) as cited in Abraham- Ibe (2014). One of the objectives of the SIWES program is to expose students to the practices in engineering specific to their chosen field of study and industry. Engineering industry often uses the most advanced technology in their operations, and by spending some time in such environment, students will gain some new experience and knowledge that would be unavailable at the schools. (Noedin, et al 2013). To SIWES of carpentry and joinery students effective, it is important to develop a work based learning guide

Work-Based Learning is an educational strategy that offers students the opportunity to connect classroom learning to authentic business and industry experience (David, 2011). For this strategy to be effective a guide is required to direct or to lead the teachers, students and the industry supervisors. Work based learning guide therefore, can be seen as an instrument used to guide and train individuals who are looking forward to be employed in different industries of their chosen career. Work based learning guide directs the industry or work based supervisors on what to teach the student who comes for industrial training, this means that, in using work based training guide, the student must have been taught the theory aspect of a career and is required to also be taught the practical aspect of such career. It is prepared in line with the curriculum so that the students do not derail from the required practical skills for certification of a career from technical colleges. The WBLG provides an organized skill-acquisition delivery system to guide the industry-based -supervisor and the students' through the various operations in carpentry and joinery technology, as well as guide the technical college-based -supervisor in the assessment procedure and give uniformity in the training process for the students. Without the WBLG, training instructions will be done according to varying discretions and experience of the industry based supervisors which may disorganize the industrial training programme and making assessment difficult thereby bringing apathy in the grading system. Hence, the need for the development of work based learning guide (WBLG) for carpentry and joinery students in Computer Aided Design CAD in Technical Colleges.

Statement of Problem

The goal of technical education is to learn skills, practice it and be perfect in it. Hence, technical colleges were established to train individuals to acquire practical skills, basic scientific knowledge and attitudes required as craftsmen and technicians at sub-professional level, to meet the manpower needs for national development. Achieving the goals of technical education in technical colleges in the country is far below

actualization because institutions are not well equipped to translate classroom theory into practice or simulation of real work situation. The apparent low level of exposure of students in training to acquire practical skills in the school workshops is largely dependent on lack of physical facilities such as workshop, laboratories, equipment and tools (Okorie, 2000). To breach the gap between theory and practice, the Students Industrial Work Experience Scheme (SIWES) often referred to industrial training (IT) was established in 1973. Sadly, SIWES has failed to meet the practical needs of students. According to Umoh (2000), approximately three quarters of students in vocational technical education embarking on SIWES have insufficient skills to cope with high technology demands and high-skilled jobs. Trainees often complain that Industry-Based Supervisors delegate menial jobs to them and they were not well-supervised during the period of attachment in the industries. A lot of students who have done industrial attachment over the past years were not supervised adequately by the supervisors from the institutions and industries. This might have been due to the absence of WBLG for industry supervisors and lack of an already existing inventory of tasks in carpentry and joinery for use by supervisors during SIWES programme.

The absence of a WBLG may have created a vacuum in the training of the students during the SIWES programme, as trainees and industry supervisor would not know what to do, when to do and how to go about certain germane industrial activities in carpentry and joinery. The absence of a WBLG has also created a gap between what trainees can do and what they are supposed to be capable of doing. Since most of industrial - supervisors have no benchmark or judgment standard to carry out proper evaluation that would improve skill, knowledge and attitude of the trainees in the industries, the WBLG will help to bridge the gap as a means of improving skill acquisition in student. WBLG will also help to eliminate the subjective grading system on the part of the supervisor that constitutes evaluation crisis or unguided evaluation. The WBLG will also be useful to accommodate the vital training in carpentry and joinery craft students in computer aided. Hence, this study was carried out to develop a work-based learning guide for SIWES Supervisors in training carpentry and joinery on computer aided design (CAD).

Aims and objective of the Study

The aim of the study is to develop a work based learning guide for industrial training of carpentry and joinery students in computer aided design (CAD) in technical colleges in south-south. Specifically, the study sought to determine the computer aided design skills appropriate for inclusion in the work- based learning guide for industrial training of carpentry and joinery students in technical colleges in South-South

Research Question

What are computer aided design (CAD) skills appropriate for inclusion in the work-based learning guide for industrial training of carpentry and joinery Students Technical Colleges in South-South?

Hypothesis

The hypothesis was formulated and tested at .05 level of significance.

There is no significant difference between the mean responses of industry-based supervisors and teachers on the computer aided design (CAD) skills appropriate for inclusion in the work-based learning guide for industrial training of carpentry and joinery Students Technical Colleges in South-South.

Methodology

The study adopted Research and Development (R&D) design. Gall, Borg & Gall (2007) attest that when the use of research findings is utilized in designing and developing new programme, materials, that will provide knowledge and skills, research and development is appropriate. System Approach Model in research and development by Dick and Carey as cited by Borg and Gall (2007) was adopted for this study. This identified eight steps namely;

1. Identification of goal of instructional program
2. Identification of specific skills
3. Identification of learning tasks and procedures
4. Translating goals into specific objectives
5. Development of assessment instrument
6. Development of instructional strategy
7. Development of instructional materials
8. Evaluation.

However, the eight steps of Dick and Carey was modified into five steps namely

i. Determination of goals for work-based learning Guide for industrial training of carpentry and joinery students in computer aided design (CAD).
ii. Development of instrument
iii. Validation of instrument
iv. Need Assessment
v. Development of Work Based Learning Guide.

Preliminary study was carried out to determine skills for industrial training of carpentry and joinery. A Self-Structured 5 Point Likert Scale Questionnaire titled Determination of Goals for Work-Based Learning Guide for Industrial Training of Carpentry and Joinery Students in (DGWBLGITCJS) was developed after a review of relevant literature relating to the study and was distributed to 50 respondents consisting of 20 carpentry and joinery teachers and 30 industry based supervisors. Result revealed that carpentry and joinery students need skills in construction drawing, basic joinery, form work, framing, wood work machine (portable power tools) operation, wood work machine (machine tools) operation and communication as well as skills in computer aided design (CAD). Thereafter a structured five point Likert scale instrument titled Computer Aided Design (CAD) Skills Appropriate for Inclusion in Work-Based Learning Guide for Industrial Training of Carpentry and Joinery Students Technical Colleges in South-South (CADSAIWBLGITCJSTCSS).

The tasks were produced using the content of each skill specification and specific objective broken into sequential step. The instruments were administered to 170 and industry supervisors working in the industries; 120 teachers and instructors in technical colleges south-south.

The various instruments were validated by three experts comprising, one industry supervisor from Rivers State one industry supervisor from Bayalsa and one lecturer in the department of Industrial Technical Education, Ignatius Ajuru University of Education Port Harcourt. Validates carried out both face and content validity. They assessed the whole draft, deleted and added appropriate words and make general comments for the improvement of the Work Based Learning Guide.

The internal consistency of the instrument was determined using Cronbach Alpha method. The questionnaire was distributed to fifteen respondents, comprising eighteen instructors and teachers teaching carpentry and joinery and five industry based supervisors which yielded a reliability of .88 indicating that the instrument was highly reliable.

The work base learning guide was developed by the researcher after carrying need assessment through the administration of questionnaires to experts in the field of carpentry and joining. The result obtained after data analysis was used to determine the objectives and content. Each section of learning guide had accompanying observable rating scale and training self-check list test. The sequential steps, self-check test, learning guide and introduction to learning guide developed by the researcher, makes the developed learning guide self–contained and self-sufficient instructional unit that will enable trainee to study on their own pace. After the final copy was developed, try-out was conducted with the permission from the Head of Department of industrial and technical education at both Rivers State and Bayalsa State. The NTC 11 students were chosen because they have learnt about carpentry and joinery in theory thereby required the practical skills. The try-out was carried out during normal school periods. The total number of 50 technical college students, carpentry and joinery option were tried out on learning guide utilization. The trainer was given one week to under study the learning guide. The training was carried in three weeks. The rating scale was used to rate before and after training without the trainee knowledge in order to assess the students' exhibition of natural behavior. A total of four weeks was planned to be used for the try-out. The rating scale was based on the content, specific objectives and sequential step of each learning guide. The scores of students obtained from first and second rating were analyzed and used to test the hypothesis. Based on hypothesis result obtained the final package was adopted.

Population for the Study

The population of the study consisted of three hundred (300) industry based supervisors, forty instructors and eighty carpentry and joinery teachers amounting to a total of four hundred and twenty (420) respondents. The number of industry supervisors, instructors and teachers were obtained from records of National board for technical education (NBTE).

Sample and Sampling Technique

The sample techniques uses for size of the industry based supervisors was determined using simple random sampling technique. Thereafter Yarrow Yemens formular was applied on the number of supervisors which yielded a sample size of one hundred and

seventy (170) respondents and the entire population of one hundred and twenty (120) teachers was used for the study. Therefore the total sample size for the study consisted of two hundred of ninety respondents (290).

Method of Data Collection

Two hundred and ninety copies of the questionnaire were administered on respondents in South-South with the help of two Research Assistants. The Research Assistant were instructed on proper administration, good handling and retrieval process of the questionnaire. The researcher personally administered questionnaire to instructors of carpentry and joinery. Copies of questionnaire were retrieved for analysis after two weeks. All copies of the instruments were returned.

Method of Data Analysis

The mean and standard deviation was employed in analysing all the various instruments used for the study. The decision for the research questions were based on cut-off point of 3.5. In other words, any item with mean 3.5 and above was considered as appropriate and was accepted. While any mean below 3.5. was taken as inappropriate and not be accepted. An independent t-test was used to test the hypothesis at .05 level of significance. To test the hypothesis. When the calculated the t value exceeded the table the null hypothesis was rejected however when the calculated t value is less than the table value the null hypothesis was accepted.

Data Presentation and Analysis

Research Question: What are computer aided design (CAD) skills appropriate for inclusion in the work-based learning guide for industrial training of carpentry and joinery Students Technical Colleges in South-South?

Table 1: Computer Aided Design (CAD) Skills Appropriate for Inclusion in the Work-Based Learning Guide for Industrial Training of Carpentry and Joinery Students Technical Colleges in South-South.

S/N	Items	Supervisors			Teachers		
		$\bar{X}$	SD	RMK	$\bar{X}$	SD	RMK
1.	Installing CAD software in computer	3.93	.84	A	4.42	.51	A
2.	Understanding various CAD tools	4.29	.79	A	4.67	.49	A
3.	Saving documents	4.29	.79	A	4.42	.52	A
4.	Editing and modifying drawings	4.29	.79	A	4.40	.55	A
5.	Working with layers	4.49	.51	A	4.20	.45	A
6.	Working with 2D plane	4.44	.50	A	4.20	.45	A
7.	Working with 3D plane	4.16	.56	A	4.40	.55	A
8.	Creating blocks in drawing	4.22	.60	A	4.40	.55	A
9.	Mirroring a drawing	4.27	.62	A	4.20	.45	A
10.	Use of short cuts command	4.10	.95	A	4.25	.87	A
11.	Placing light in a drawing	4.42	.50	A	4.50	.67	A
12.	Attaching materials in a drawing	4.67	.48	A	4.48	.55	A
13.	Creating 2D drawing from 3D	4.31	.56	A	4.40	.55	A
14.	Produce solid model	4.49	.51	A	4.40	.55	A
15.	Exporting drawing	4.56	.50	A	4.42	.51	A

16.	Working with vector and raster images	4.33	.60	A	4.60	.55	A
17.	Isometric drawing	4.40	.58	A	4.20	.84	A
18.	Perspective drawing	4.51	.51	A	4.40	.55	A
19.	Axonometric drawing	4.51	.59	A	4.60	.55	A
20.	Sectioning	4.53	.59	A	4.60	.55	A
21.	Rendering	4.33	.65	A	4.80	.45	A
22.	Visual/photo editing	4.47	.51	A	4.25	.87	A
23.	Modelling skills	4.60	.50	A	4.40	.55	A
24.	Simulate a drawing	4.56	.50	A	4.80	.45	A
	Grand mean	4.38	0.61		4.43	.57	

Source: Field Survey 2021

Table 1 above show mean responses of industry supervisors and teachers on the computer aided design (CAD) skills appropriate for inclusion in the work-based learning guide for industrial training of carpentry and joinery Students Technical Colleges in South-South. The mean score of the respondents exceeded the criterion mean of 3.50. The grand mean of superiors and teachers stood at 4.38 and 4.43 respectively indicating all the items in table 1 are appropriate for inclusion in the work based learning guide.

Hypothesis: There is no significant difference between the mean responses of industry-based supervisors and teachers on the computer aided design (CAD) skills appropriate for inclusion in the work-based learning guide for industrial training of carpentry and joinery Students Technical Colleges in South-South.

Table 2: Independent Sample T-Test to Compare the Mean Responses of Supervisors And Teachers on the Computer Aided Design (CAD) Skills Appropriate for Inclusion in the Work-Based Learning Guide for Industrial Training of Carpentry and Joinery Students Technical Colleges in South-South.

Respondents	No	$\bar{X}$	SD	DF	T-cal	T-crit	P	Decision
Supervisors	170	4.38	.61					
				288	0.56	1.96	.05	Accept
Teachers	120	4.43	.57					

Table 2 is an Independent Sample T-Test conducted to compare the mean responses of supervisors and teachers on the computer aided design (cad) skills appropriate for inclusion in the work-based learning guide for industrial training of carpentry and joinery students technical colleges in south-south. The mean of supervisors is 4.38 with a standard deviation of .61 and the teachers had a mean of 4.43 with a standard deviation of .57. The calculated t value is .56 and the table value is 1.96. The degree of freedom is 288. Since the calculated t value OF .56 is greater than the table value 1.96, the null hypothesis was upheld.

Discussion of Finding

Based on the data gathered from the respondents the following findings emerged from the study installing cad software in computer, understanding various cad tools, saving documents, editing and modifying drawings, working with layers, working with 2D plane, working with 3D plane, creating blocks in drawing, mirroring a drawing, use of short cuts command, placing light in a drawing, attaching materials in a drawing, creating 2D drawing from 3D produce solid model and son on are skills appropriate for inclusion for work based learning guide. The findings of the study is harmony with Uka and Orji (2020) who listed rendering, modelling, editing, mirroring drawing, working with layers as skills required of block laying and concreting students for employment. In addition Osakue (2020) supported the findings of the study of study by reiterating the need for acquiring CAD skills. It was

recommended that since the traditional 2D drawings such as isometric sketches and orthographic sketches are steadily becoming obsolete with the invention of 3D modeling in CAD software it is important to train carpentry and joinery students on the use of AutoCAD. Modeling is the current practice in the technical industry. Engineering and allied companies are in need of design drafters who can model because modeling creates more accurate design, additionally it is easier to generate to 2D Drawings from them. Hence, it is important to include CAD as a skill in work based learning guide.

Summary and Conclusion

The absence of a WBLG may have created a vacuum in the training of the students during the SIWES programme, as trainees and industry supervisor would not know what to do, when to do and how to go about certain germane industrial activities in carpentry and joinery. To that end the research sought to develop a work based learning guide for training students in carpentry and joinery students in computer aided design. The respondents agreed on all the items as skills appropriate for inclusion for the work based learning guide.

Recommendation and Conclusion

Based on the findings of the study the following recommendations were made

a. The industry based supervisors should be trained on the effective use of the work based learning guide.

b. The Industrial Training Fund (ITF) should ensure that the work-based learning guide be made available to all carpentry and joinery students in SIWES as wells their industry based supervisors.

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