COMPUTER AIDED DESIGN AND DRAFTING SKILLS FOR EFFECTIVE TVET PROGRAMME IN TERTIARY INSTITUTIONS LOCATED IN KANO STATE, NIGERIA

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Abstract:

Computer Aided Design and Drafting (CADD) skills acquisition of current TVET undergraduate of Nigeria tertiary institutions has been criticised for not meeting the desired goals. The technical drawing sessions give less emphasis to CADD software. The objectives of the study were to find out the skills needed for the application of CADD in TVET program, to ascertain the students' capability of CADD application in TVET program, to discover the prospects of CADD application while designing and the constraints hindering the effective application of CADD in TVET program. Four research questions were developed based on the study objectives. 97 (ninety-seven) final year Technical Education students at Bayero University Kano (BUK) and 66(sixty-six) Federal College of Education Technical FCE(T) Bichi final year students, were the study population. 108 (one hundred and eight) students were used as the sample of the study. Descriptive survey method was adopted in the research work. Questionnaire (CADDSKILL) was developed and validated by three experts in the field of Drafting Technology Education, 0.85 for section A, 0.76 for section B, 0.74 for section C and 0.80 for section D, correlation co-efficient reliability indexes were obtained using split half method for ensuring consistency of these instruments. Mean and standard deviation were used for data analysis. The findings of the study showed that; problem solving skills, long term learning skill, ability to learn using video tutorial and computer operation skill were the skills needed. It is recommended that the students must have those CADD skills and learn CADD diligently, as this will improve their experience and enable them become more versatile and conversant with CADD packages.

Keywords: Computer Aided Design and Drafting, (CADD) Skills, Technical and Vocational Education and Training program.

Introduction

According to Federal Republic of Nigeria (2014) and Lawal (2013), Technical and Vocational Education and Training (TVET) was explained as a comprehensive term denoting those aspects of the educational process including general education as well as the study of technology and related science. It is also the attainment of practical skills, attitudes and comprehension of knowledge that are related to occupation in various areas of economic and social life. For a country to advance socially, economically and technologically, its citizens must be productive and creative.

Furthermore, the goals of technical and vocational education as documented in the National Policy on Education (2014) are to provide trained manpower in the areas of applied science and technology, business (particularly at craft and advanced craft levels), technical knowledge and vocational skills necessary for agriculture, commercial and economic development. The purpose of this is to give training and impact the necessary skills to individual who shall be self-reliant economically. In addition, Chih-Yang, Chi-Lun and Chien-Lin (2011) describes the aim of vocational education as cultivating the skills needed for the occupation and to establish the correct vocational attitude. However, vocational education is subject to constant social change, technical development and organizational demand, as these changes do lead to shift from traditional method of teaching technical drawing to computer-based method, that is Computer Aided Design and Drafting (CADD).

Reagan and Robinson, (2016) explained CADD as 'the use of computer systems to assist in the design, reformation, exploration, or optimization of a model or design'. Computer-aided drafting describes the process of making a technical drawing with the use of computer software. Olukoya and Kuti (2015) further refer to Computer-aided design (CAD) as process of using computers and special software to create virtual three-dimensional models and two-dimensional drawings of products. Numerous types of CAD software have been developed for use across a range of disciplines and industries. CADD software is used to increase the productivity of the designer, improve the quality of drawings, improve communications through documentation, and to create a database for manufacturing. CADD software uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. Furthermore Joyce (2013) gave a highlight on the benefits of CAD to include accuracy, creativity, time saving, effective teaching, innovation, good presentation and raising the standard of design. Olukoya and Kuti (2015) further buttressed that Computer-Aided Design (CAD) has had a radical impact upon teaching, learning and practice of technical design.

Technical and Vocational Education and Training (TVET) program is a skill-based learning program which places emphasis on the students' acquisition of motor skills and other capabilities through exercises or practical application sessions. The skill learning must be aided by repeated practice over a long period so that the learner can be proficient in the said skills. Skill learning is also a process that combines the individual intelligence and actions, which is also a chain of multiple reactions and multiple actions. It is therefore more complicated than learning an action.

Most of the students that master those CADD package were able to know their technical weaknesses and made up for it during the long-term training, and were also taught to make better use of their time and resources. Certainly, through these means, their skills can be greatly improved.

Chih-Yang, et al (2011) reiterated that conducive environment and adequate CADD resources do play great role in providing the students with the opportunity to practice and improve their skills. CADD skills are necessary for any TVET student to have, as it enables them become more conversant with those sophisticated CADD packages. The typical standard CADD settings or studio in a school organization required that each student should have a high capacity computer with CADD package installed, internet connection, competent CADD teacher, steady electricity supply and sufficient time for practice.

Statement of Problem

The use of CADD packages provide numerous advantages in the field of technical drawing and design. It is highly imperative for the technical drawing teachers to know the skills needed for a student to successfully learn the CADD applications, the time required for enough practice, and the required studio equipment needed. Technical drawing skills acquisition of current TVET undergraduate of Nigeria tertiary institutions has been criticized by researchers like (Hassan and Maizam 2017), for not meeting the desired goals. The technical drawing sessions give less emphasis to CADD software. Hence the reviewed literature above shows the need for producing well skilled technical drawing teachers for TVET program in Nigeria that can effectively teach drafting technology using traditional method and computer-based method. This is the only way through which sound and productive TVET students can communicate effectively using graphic language which fits into the current industrial revolution. Medupin (2015), Ogbuanya and Anied (2013), Sulaiman and Akeem (2014).

The study tried to find out the skills needed for effective application of CADD, the advantages of using CADD in TVET program, the students' ability of using CADD in TVET program and the constrains affecting the effective CADD application in TVET program in Kano State Nigeria.

Objectives of the Study

The objectives of the study are to:

i. Find out the skills needed for effective application of CADD in TVET program in Kano State tertiary institutions
ii. Ascertain the students' capability of CADD application in TVET program in Kano State tertiary institutions
iii. Discover the prospects of CADD application while designing, in Kano State tertiary institutions

iv.   Find out the constraints hindering the effective application of CADD in TVET program in Kano State tertiary institutions

Research Questions

The following research questions will be answered:

i.   What are the skills needed for effective application of CADD in TVET program in Kano State tertiary institutions?
ii.   Are the students capable of using CADD packages in the design process in Kano State tertiary institutions?
iii.   What are the prospects of using CADD in TVET program in Kano State tertiary institutions?
iv.   What are the constraints that hinder the effective application of CADD in TVET program in Kano State tertiary institutions?

Methodology

Design of the Study

Descriptive survey method was adopted in the research work. According to Gall., Gall and Borg (2007) a survey is a method of data collection using questionnaire or interviews to collect data from a sample that has been selected to represent a population to which the findings of the data analysis can be generalized.

Area of the Study

The area of study consists of two tertiary institutions in Kano State Nigeria, namely Bayero University Kano (BUK) and Federal College of Education Technical FCE(T) Bichi.

Population of the Study

The population for this study consists of 97 (ninety-seven) 2017/18 academic session final year Technical Education students in Automobile technology, Building technology, Electrical technology, Metalwork technology and Woodwork technology Education from Bayero University Kano (BUK), as well as 66 (sixty-six) number of students from Federal College of Education Technical FCE(T) Bichi.

Sample for the Study

A total sum of 108 (one hundred and eight) students were used as the sample for the study. The selection of sample size was based on Research advisor (2006). Simple random sampling technique was used in selecting the sample. The selection of the technique was based on the fact

that members of a given population tend to have equal and independent chance of being included in the sample and that each choice is independent of any other choice (Gay, Mills & Airasian, 2009).

Instrument for data collection

The instrument that was used to collect the data was a structured researchers'- made questionnaire from the reviewed literature and researchers' experience titled CADDSKILL. The instrument is a four-point rating scale of Strongly Agree (SA), Agreed (AG), Disagreed (DA) and Strongly Disagreed (SD) with numerical values of 4, 3, 2 and 1 respectively. The instrument is divided into four sections, A, B, C and D. Section A finds information on skills needed for effective application of CADD in TVET, while Section B seeks information on the students' ability of CADD application in TVET program. Section C was on the prospects of CADD application in design process in TVET program, while section D dealt with the information on problems hindering the effective application of CADD in TVET program in Kano State.

Validation of the Instrument

The instrument was face and content validated by three experts in the field of Drafting Technology Education. They were required to indicate any irrelevant statement(s) or wrongly worded items. The suggestions and recommendations of validators were integrated into the modified copy of the questionnaire that was used for data collection.

Method of data Collection

The data were collected by the researchers and were supported by the research assistants in the two tertiary institutions covered by the study. Although, a total of 120 (one hundred and twenty) questionnaires were distributed, however, only 108 (one hundred and eight) were returned correctly completed by the respondents. The correctly returned questionnaires were therefore used for data analysis.

Reliability of the Instrument

0.85, 0.76, 0.74 and 0.80 reliability correlation co-efficient indexes respectively for Sections A, B, C and D were obtained using split half method for ensuring consistency of the instruments. This was considered relatively high enough, and as a result, it was confirmed that the instrument is highly reliable to measure what it was designed for.

Method of data Analysis

Data collected was analysed using mean and standard deviation obtained from responses on the four-point response categories with SPSS version 25. For decision, item with Mean of 2.50 and above was considered as having high Means, which indicates that students required that skill and needed to be trained. Any item with Mean rating less than 2.50 was considered as low and that the students do not require the skill.

Results

Research Question one: What are the skills needed for effective application of CADD in TVET program in Kano State tertiary institutions?

Table 1: Mean Scores of the Respondents on the skills needed for effective application of CADD in TVET program in Kano State tertiary institutions N = 108

S/N	STATEMENTS	X	SD	Remarks
1	Problem solving skill	4.00	0.00	Agreed
2	Long term learning skill	3.32	0.78	Agreed
3	learning using video tutorial skill	3.41	0.49	Agreed
4	Learning using paper-based tutorial skill	3.69	0.46	Agreed
5	Computer operation skill	3.80	0.40	Agreed
6	Critical thinking skill	3.39	0.49	Agreed
7	Judgement and decision-making skill	3.39	0.49	Agreed
8	Mathematics skill	3.10	0.29	Agreed
9	Reading comprehension skill	3.41	0.49	Agreed
10	Innovation and creativity skill	3.61	0.66	Agreed
	Grand mean	**3.51**	**0.46**	**Agreed**

Source: Field Survey, 2018

Data presented in Table 1 shows that the respondents agreed on all the items on the skills needed for effective application of CADD in TVET program in Kano State tertiary institutions. The standard deviation shows that the respondents are close on their responses based on the mean range of 3.10 to 4.00 and standard deviation of 0.00 to 0.78.

Research Question two: Are the students capable of using CADD packages in the design process in Kano State tertiary institutions?

Table 2: Mean Scores of the Respondents on the capability of CADD application in TVET program in Kano State tertiary institutions N = 108

S/N	STATEMENTS	X	SD	Remarks
1	I use CADD software in my program	4.00	0.00	Agreed
2	I can produce complex design with CADD software	2.40	0.49	Disagreed
3	I learned CADD course each semester in my program	1.30	0.46	Disagreed
4	I can produce 3D model and generate 2D drawing from it without any difficulty using CADD applications	1.80	0.74	Disagreed
5	I can work with many CADD software	1.68	0.78	Disagreed
	Grand mean	**2.24**	**0.49**	**Disagreed**

Source: Field Survey, 2018

Table 2 revealed that all the respondents agreed with item 1, that is they learned CADD in their program and disagreed with all the remaining items having the grand mean value of 2.24 which is below 2.50. item 3 has the least mean value 1.30 and item 1 with highest mean value of 4.00.

Research Question three: What are the advantages of using CADD in TVET program in Kano State tertiary institutions?

Table 3: Mean Scores of the Respondents on the prospects of CADD application while designing in TVET program in Kano State tertiary institutions N = 108

S/N	STATEMENTS	X	SD	Remarks
1	CADD packages help greatly during the design process	3.80	0.40	Agreed
2	CADD saves time and enhance accuracy in working drawings production	4.00	0.00	Agreed
3	CADD gives virtual 3D picture of the design that makes meaning to the clients	3.40	0.49	Agreed
4	CADD makes reproduction and duplication of the design easier	3.40	0.49	Agreed
5	CADD work does not required large space for storage purpose	3.80	0.40	Agreed
	Grand mean	**3.68**	**0.36**	**Agreed**

Source: Field Survey, 2018

Table 3 revealed that respondents agreed with all the items on the advantages derived from using CADD packages in TVET program in Kano State tertiary institutions, having the grand mean value of 3.68 which is above 2.50, so all the items considered agreed.

Research Question four: What are the constraints that hinder the effective application of CADD in TVET program in Kano State tertiary institutions?

Table 4: Mean Scores of the Respondents on the constraints hindering the effective application of CADD in TVET program in Kano State tertiary institutions N = 108

S/N	STATEMENTS	X	SD	Remarks
1	Inadequate supply of electricity	2.99	0.67	Agreed
2	Lack of well-equipped Computer laboratory	3.11	0.32	Agreed
3	Lack of Up-to-date CADD software.	3.00	0.68	Agreed
4	Shortage of qualified CADD teachers	2.66	0.48	Agreed
5	Lack of enough time for practice	3.23	0.42	Agreed
	Grand mean	**3.00**	**0.51**	**Agreed**

Source: Field Survey, 2018

Table 4 revealed that the respondents agreed with all the items mentioned are the constraints that hinder the effective application of CADD in TVET program in Kano State tertiary institutions, having the grand mean value of 3.00 which is above 2.50, item 2 carries the highest mean value of 3.11 and item 4 carries the least mean value of 2.66.

Summary of Findings

1. The findings of the study show that problem solving, computer operation, learning using paper-based tutorial and innovation and creativity skills are the most effective skills needed for effective application of CADD in TVET program in Kano State tertiary institutions.

2. The extent to which Kano State tertiary institutions TVET students do use CADD packages in the design process is low. This is because the students cannot work with many CADD software, produce 3D model and generate 2D drawings from it without any difficulty using CADD applications. They only learnt CADD packages in one semester throughout the program.

3. The advantages of CADD application in TVET program in Kano State tertiary institutions include: it saves time and enhance accuracy in working drawings production, packages help greatly during the design process and work made with CADD does not required large space for storage purpose.

4. Lack of enough time for practice, well-equipped computer laboratory and up-to-date CADD software were considered as some of the constraints that hinder the effective application of CADD in TVET program in Kano State tertiary institutions.

Discussions of findings

The findings of the study show that all the skills mentioned in Table 1 are among the skills needed for effective application of CADD in TVET program. In addition, it shows that there is great need for the students to have those skills, as this will give them the opportunity to master the CADD packages, so as to enjoy its numerous advantages. The result has strong congruence with the findings of Chih-Yang Chao (2011) who pointed out that all the students that took first position in design competition using CADD packages have some of those skills.

The students' ability to use CADD packages in the design process is low as shown by the findings of the study in Table 2. Only one item out of the five items showed that the respondents agreed with the statements, while they disagreed with the remaining four. This implies that most of the respondents cannot produce complex design with CADD software. They did not learn CADD package each semester in their program. In essence, they cannot produce 3D model and generate 2D drawing from it without any difficulty using CADD applications. The consequence of this is that they cannot work with many CADD software because the required time to practice adequately was not given.

Table 3 revealed the advantages of using CADD in TVET program. First, it helps greatly during the design process. Secondly, it saves time and enhance accuracy in working drawings production. Also, it gives virtual 3D picture of the design that makes meaning to the clients. Finally, it makes reproduction and duplication of the design easier. The aftermath is that the work made with CADD does not require large space for storage purpose when compared with manual drafting. These findings were in consonance with the studies of Olukoya and Kuti (2015) and Joyce (2013) where they pointed out similar prospects.

Lastly, the constraints that hinder the effective application of CADD in TVET program are inadequate supply of electricity, lack of well-equipped computer drawing studio, lack of up to date CADD software, inadequate qualified CADD lecturers and insufficient time for CADD practice as revealed by the findings of the study in Table 4. This is because CADD is taught only in level 400 second semester which is not sufficient for the students to fully learn those CADD packages. This is in line with the finding of Hassan and Maizam (2017) where they reported lack of qualified technical drawing teachers and modern teaching aids among the constraints of learning technical drawing.

Conclusion

CADD has great impact in TVET program. It serves as one of the tools that can be used to uplift the knowledge of the students in terms of industrial graphics, design and production, which enable them to meet up with the current challenges in the world of industrial design technology. It also provides technical education students with technical know-how on how to teach technical drawing effectively. Thus, identifying the skills needed for effective application of CADD in TVET program is crucial as it will help the students to learn easily, as well as improve the extent of CADD application in their career.

Recommendations

Based on the findings of this study, the following recommendations are hereby proposed:

1. The students must have those CADD skills and learn CADD diligently, as this will improve their experience and enable them become more versatile and conversant with CADD packages.
2. Apart from the traditional method of teaching technical drawing, CADD should be taught for at least three different semesters to the students during the duration of their program. As a result, the current Technical Education curriculum requires revision and updating.
3. By considering the advantages of CADD application in TVET program Lecturers should encourage the students to have in-depth knowledge on CADD application in order to benefit from it.
4. Government should try and provide all the tertiary institutions that are offering TVET program with well-equipped computer studio, standby generator, sound internet connection and high capacity computers that can accommodate latest CADD software.

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