

Training Needs of Technical Drawing Lecturers in Zamfara State

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ABSTRACT

This study determined the perception of technical drawing teachers of their training needs for effective teaching at higher institutions in Zamfara states. Three (3) research questions were developed based on the specific objectives of the study and the data was quantitatively collected using questionnaire items. 3 experts face-validated the 31 structured questionnaire items. The instrument was pilot tested using Cronbach Alpha coefficient was used to determine the reliability on 12 respondents who are not part of the population for the study and the reliability coefficient of the entire instrument was 0.85. A survey design was adopted and the respondents for the study were 37 technical drawing teachers from three tertiary institutions in Zamfara state. Copies of the questionnaire were administered on the respondents by the researcher with the help of three research assistants, one for each school. The data collected was analyzed using mean and standard deviation with the help of Statistical Software Package (SPSS statistics 23 version). The major findings of the study include among others that lecturers of technical drawing require training on site, survey floor plan and elevation drawings, projections drawing and Design of building's structure, illustrations showing how parts fit together and three orthographic views of a system. It was recommended that all the governmental and non-governmental organizations that take charge of tertiary institutions offering metal work and building technology should be fully engage in organizing in-service training for technical drawing lecturers.

Keywords: training, technical drawing, effective teaching, higher institutions and technical drawing teachers

INTRODUCTION

It has become increasingly apparent that Technical education plays a significant role in the socio-economic development of a society. Technical education is an age-long education since the emergence of human society, and the importance of technical education for individual, community and national development has always been recognized. Okoro (2006) has observed that technical education in the traditional African society has been flourishing of direct and indirect instructional initiation, which was mainly on practical instruction, learning of doing, observation, imitation and participatory learning.

The Federal Republic of Nigeria (FRN, 2004) identified different types of tertiary institutions

outside the university system to include the Colleges of Education and Polytechnics. College of education is an institution of higher learning that offers courses leading to the Nigerian Certificate in Education (NCE). They produce lecturers to teach introductory technology at a Junior Secondary level while Polytechnic as defined by National Board For Technical education (NBTE, 2010) is an institution of higher education offering instruction in a variety of vocational, technical, and scientific subjects. Apart from the instruction of pedagogy, skill acquisition is taught in courses like building technology and metal work. The core subjects that lead to the award of NCE (Technical) and diploma in technology includes Technical drawing.

Technical drawing, also known as drafting, is the act and the discipline of composing plans that visually communicate how something functions or has to be constructed (Alan, 2007). Technical drawing is one of the core courses offered in some of Nigeria Colleges of Education. Similarly, Alan further identified sets of technical drawing to include: working drawing, assembly drawing and as-fitted drawing. Working drawing according to Goestech, Chalk and Nelson (2000) referred to as the set of technical drawings used during the manufacturing phase of a product which include civil drawings, architectural drawings, structural drawings, mechanical systems drawings, electrical drawings, and plumbing drawings. On the same vein, Assembly drawings show how different parts go together, identify those parts of number, and have a parts list, often referred to as a bill of materials. In a technical service manual, this type of drawing may be referred to as an exploded view drawing or diagram and its parts may be used in engineering.

Building on the above, as-fitted drawing which is also called As-Built drawings, or As-made drawings represents a record of the completed works, literally 'as fitted' and are based upon the working drawings and updated to reflect any changes or alterations undertaken during construction or manufacture. With the advent of globalization, Barajas, Scheurmann and Kikis (2003) remarked that, lecturers of technical drawing still require adequate AutoCAD skill to suit in teaching the subject to students to meet their varying interest of stimulating academic achievement. AutoCAD is a computer-aided drafting software program used for creating blueprints for buildings, bridges and computer chips. AutoCAD is used mainly of drafters, although engineers, surveyors and architects may need to use the software from time to time (Clark, 2011)

In addition to the above, among the objectives of instruction the course as contained in the Federal Government of Nigeria (FRN, 2004) technical drawing curriculum are to:

1. Instill the communicative skills and knowledge of way of drawing to all technical education students.
2. Enable students interpret other peoples' ideas and designs on drawing paper. And

3. Train technical students on how to put down their ideas as blue prints guided of the design process and conventional standards.

To achieve these objectives, Adamu (2014) perceived that there is a need for technical drawing lecturer to undergo certain trainings for students to a clear understanding of technical drawing concepts. Training according to Hall and Hord (2007) is the acquisition of knowledge, skills, and competencies as a result of the instruction of vocational or practical skills and knowledge that relate to specific useful competencies. Training has specific goals of improving one's capability, capacity, and performance. It forms the core of apprenticeships and provides the backbone of content at Colleges of Education and Polytechnics. Duzan (2006) opined that, in addition to the basic training needed for a trade, occupation or profession, observers of the labour-market recognized that as of 2008 there is a need to continue training beyond initial qualifications: to maintain, upgrade and update skills throughout working life.

Additionally, People within many professions and occupations including instruction may refer to this sort of training as professional development. Professional development as perceived by Christine (2008) is a process of staff development for the purpose of improving the performance of an incumbent holding a position with assigned job responsibilities. It promotes the professional growth of individuals. "It is a program designed to strengthen the competencies of extension workers while they are on the job" (John and Dale, 2004). In the case of teaching profession, therefore, for any instruction-learning enterprise to be meaningful and effective, it must involve the lecturer, and the students in sharing of common wearing or the value of thought and experiences as well as receiving messages from the environment through the subject matter (Aliyu, 2009).

More so, effective instruction as perceived by Adams (2006) involves a deep understanding of subject matter, learning theory and student differences, planning, classroom instructional strategies, knowing individual student, and assessment of students understanding and proficiency with learning outcomes. They also include a lecturer's ability to reflect, collaborate with

colleagues and continue ongoing professional development (Clark, 2005). Effective instruction in technical drawing is the degree or level to which technical drawing objectives are achieved that will lead the students to acquire the knowledge, skills and competencies necessary for technical drawing subject (Richardson, 2003). This implies (in this case) that before learning can be said to have taken place during technical drawing lesson, there must be a lecturer of technical drawing, the students and the subject matter of technical drawing.

In essence, the way technical drawing concepts are communicated to the students may also depend on the kind of training received of the lecturer. The National policy on education has stated that the minimum instruction qualification in Colleges of Education and polytechnics is B. Sc. (ed)/ B. Tech. (ed) degree which off course include lecturers of technical drawing. In this regard, for any lecturer of technical drawing to teach effectively at tertiary institutions and to ensure mutual understanding, he must possess adequate training for carrying out this assignment of instruction in the classroom. At least, a technical drawing lecturer should be adequately trained. Researches indicated that conducting training in organizations offers promising opportunities to meet the challenges of an ever-changing environment (Arechaga, 2005).

To this end, Lecturer training, having a remarkable potential to contribute to sustained education excellence, have been identified as key tools in educational processes. In a technical institution, Lecturer training can be used as an educational tool that prepare lecturers, innovate and facilitate learning (Anderson, 2007). Unfortunately, many technical drawing lecturers in colleges of education and polytechnics as perceived by Fuller (2006) lacked the requisite training to effectively implement the basic technical drawing subject matter. Could there not be any means for improving the training of lecturers of technical drawing for good instruction performance? There is, therefore, every need to identify means that could improve training of the lecturers of technical drawing. Specifically, the study will identify in-service training needed by the technical drawing lecturers for effective instruction of metal work and building technology at the tertiary

institutions offering metal work and building technology in Zamfara state, Nigeria.

Statement of the Problem

Globalization has created a new world order for doing any sort of activity. An important component of the education sector reforms is lecturer training (Hatton and Smith, 2005). To achieve this laudable goal, lecturers should undergo skills training become imperative. More so, Researches indicated that considerable success seems to have been recorded in the area of lecturer training and provision of training equipment at the Universities much more than that at the Colleges of Education and polytechnics. At the Colleges of Education and polytechnics in the North Western Nigeria which off course include Zamfara state, Adamu (2014) reported that skills training of lecturers grossly inadequate.

Building on the above, this inadequacy of facilities in the Colleges of Education and Polytechnics resulted to students often fail to reach a satisfactory level of proficiency in problem-solving mostly in technological oriented courses. It seems that students often fail to reach a satisfactory level of proficiency in problem-solving mostly in technological oriented subjects because of the lack of training of the lecturers. With the advent of globalization, Gershner and Snider (2003) remarked that, lecturers of technologies still lack adequate skills to suit in a particular lesson taught to students that would meet with their varying interest thereof stimulating academic achievement. It seems the absence of training lead to poor performance of students in technical drawing in the colleges of education and Polytechnics in the North western Nigeria which off course include Zamfara state (Adamu, 2014).

It is apparently clear that there are different views from different researchers such as Wheeler (2002) and Hosman (2010) about how the nature of metal work and building technology concepts and different instruction techniques affect the learning outcome of students' academic achievement levels. It is a fact that students differ in their academic achievement level which resulted in poor performance in evaluative test thereof developing poor attitude and lack of desirable success needed

for academic success and this problem will persist unless teacher skills training is enhanced and improved. To this end, there is a keen need to determine the in-service training needed by technical drawing lecturers for effective instruction of metal work and building technology concepts at the tertiary institutions offering metal work and building technology in Zamfara state, Nigeria.

Research Questions

This study found answers to the following specific questions:

1. What are the working drawing training needed by the technical drawing lecturers for effective instruction metal work and building technology concepts at the tertiary institution in Zamfara state?
2. What are the assembly drawing skills training needed by the technical drawing lecturers for effective instruction metal work and building technology concepts at the tertiary institution in Zamfara state?

METHODOLOGY

The descriptive survey research design was used for this study which enabled the researchers to seek information from the entire population. The design was appropriate for the study as it obtained data from the technical drawing Lecturers of tertiary institutions offering metal work and building technology in Zamfara state using

questionnaire. The study was carried out in Zamfara State, covering all the 3 tertiary institutions offering technical drawing. The entire population for the study were 37. Since the population is manageable, no sampling was carried out. The instrument for data collection was a structured questionnaire organized in accordance with the research questions formulated that guided the study. The questionnaire was structured on a 4-point Likert scales of Highly Needed HN (4), Needed N (3), Moderately Needed MN (2) and Not Needed NN (1). The instrument were face-validated by three experts in the School of Vocational and Technical Education, Federal College of Education (Technical), Gusau, Zamfara state.

The Cronbach Alpha coefficient was used to determine the reliability of the instrument obtained by administering a single test to 12 Technical Drawing lecturers from Hassan Usman Katsina Polytechnic, Katsina. The reliability coefficient of the entire instrument (α) was 0.82. The validated copies of the instrument were administered on the respondents through personal contact and with the help of a research assistant and hundred percent return rate was achieved. The data collected was analyzed using mean and standard deviation for answering the research questions. In taking decision, any item with mean of 2.50 and above will be considered as Needed (N) and, less than 2.50 as Not Needed (NN).

RESULTS

Table 1: Mean and Standard Deviation of the Respondents' Responses on the Working Drawing Skills Training Needs of the Technical Drawing lecturers for Effective Instruction of metal work and building technology concepts at the Tertiary Institutions

SN	Working Drawing skills training needed by the technical drawing Lecturers include training on:	X	SD	Remarks
1.	Site plan and survey drawing	3.21	1.01	Needed
2.	Floor plan and elevation drawing	3.53	1.06	Needed
3.	Projections drawing and Design of building's structure	3.10	1.00	Needed
4.	Detailing, fabricating and installing parts of structure	2.98	0.97	Needed
5.	Information about heating, ventilating and air conditioning design	3.00	1.05	Needed
6.	Analysis of the complex systems	3.91	1.04	Needed
7.	Detailed drawing for construction projects	3.09	0.95	Needed
8.	A plot plan showing the building's location and outside electrical wiring	3.52	1.23	Needed
9.	Floor plan showing the location of electrical system on every floor	3.90	1.01	Needed

SN	Working Drawing skills training needed by the technical drawing Lecturers include training on:	X	SD	Remarks
10.	Power-riser diagrams showing panel board	3.87	1.22	Needed
11.	Control wiring diagram and Graphical representation of parts	3.45	0.98	Needed
12.	Design of road ways, bridges and sewer systems	3.70	1.03	Needed
13.	Explanatory notes and descriptive title on the drawing	2.97	1.27	Needed
14.	Design layout and Relationship of each part to other	3.06	1.06	Needed
15.	Description of forms, dimensions and construction	3.76	1.15	Needed

Table 1 revealed that the respondents agreed in all the 15 items on the Working Drawing skills training needed by the technical drawing Lecturers. This is because, the mean responses of the respondents in all the items ranged from 2.97-

3.91 which are greater than the cut-off point of 2.50. The standard deviation of the items ranged from 0.95-1.27 which indicated a consensus of opinion by the respondents.

Table 2: Mean and Standard Deviation of the Respondents' Responses on the Assembly Drawing Skills Training Needs of Technical Drawing Lecturers for Effective Instruction of metal work and building construction concepts at the Tertiary Institutions.

SN	Assembly Drawing skills training needed by technical drawing Lecturers include, training on:	X	SD	Remarks
16	Illustrations showing how parts fit together	3.45	1.02	Needed
17	Three orthographic views of a system	3.24	0.96	Needed
18	Complete presentation of product or structure, showing all parts in their operational positions	3.85	1.01	Needed
19	Note explaining the needed operation and dimensions for the alignment or location of the pieces	3.10	1.00	Needed
20	Tracing from the design layout	3.29	1.05	Needed
21	Unit assembly drawing	3.34	1.00	Needed
22	Outline drawing	2.67	1.05	Needed
23	Reference letters and numbers representing different parts	3.81	1.12	Needed
24	Tabular assembly drawing	3.34	1.00	Needed
25	Preparation of bill of material (BOM)	3.65	1.03	Needed
26	Standardized drawing	3.61	1.26	Needed
27	An exploded view drawing	3.75	1.03	Needed

Table 2 revealed that the respondents agreed in all the 12 items on the Assembly Drawing skills training needed by technical drawing Lecturers. This is because, the mean responses of the respondents in all the items ranged from 2.67-3.85 which are greater than the cut-off point of 2.50. The standard deviation of the items ranged from 0.96-1.26 which indicated a consensus of opinion by the respondents.

FINDINGS

Based on the analyzed data, the following findings were emerged from the study:

- (A) Working Drawing Skills Training Needs of the Technical Drawing lecturers for Effective Instructions at the Tertiary Institutions.
1. Site and survey drawing
 2. Floor plan and elevation drawing
 3. Projections drawing and Design of building's structure
 4. Detailing, fabricating and installing parts of structure

5. Information about heating, ventilating and air conditioning design
6. Analysis of the complex systems
7. Detailed drawing for construction projects
8. A plot plan showing the building's location and outside electrical wiring
9. Floor plan showing the location of electrical system on every floor
10. Power-riser diagrams showing panel board
11. Control wiring diagram and Graphical representation of parts
12. Design of road ways, bridges and sewer systems
13. Explanatory notes and descriptive title on the drawing
14. Design layout and Relationship of each part to other
15. Description of forms, dimensions and construction
- (B) Assembly Drawing Skills Training Needs of Technical Drawing Lecturers for Effective Instruction at the Tertiary Institutions.
16. Illustrations showing how parts fit together
17. Three orthographic views of a system
18. Complete presentation of product or structure, showing all parts in their operational positions
19. Note explaining the needed operation and dimensions for the alignment or location of the pieces
20. Tracing from the design layout
21. Unit assembly drawing
22. Outline drawing
23. Reference letters and numbers representing different parts
24. Tabular assembly drawing
25. Preparation of bill of material (BOM)
26. Standardized drawing
27. An exploded view drawing

DISCUSSION OF FINDINGS

The study found that training on Site plan, survey, Floor plan and elevation drawing is needed by the lecturers. This findings is in line with the recommendations made by Ozen (2007) that site plan as a specific type of plan, shows the whole context of a building or group of buildings: and also shows property boundaries and means of access to

the site and nearby structures if they are relevant to the design. This finding also concise with the view of Stacey (2010) that a floor plan as the most fundamental architectural diagram, shows the arrangement of spaces in building in the same way as a map, but showing the arrangement at a particular level of a building.

The study also found that lecturers require training on Projections drawing, design of building's structure, road ways, bridges, sewer systems, layout, and relationship of each part to other. This study corresponds with the findings of French (2008) that projection drawings are a simple way of representing a three dimensional object, keeping the elements to scale and showing the relationship between several sides of the same object, so that the complexities of a shape should be clearly understood. More so, Taha (2013) recommended that the importance of building design include that drafters draw up plans for use in the design and building of roadways, bridges, sewer systems and other major projects. It was also founded that lecturers require training on information about heating, ventilating, air conditioning design and analysis of the complex systems. This finding is in line with the recommendation made by Perker and Pic-up (1990) that a mechanical system drawing as a type of technical drawing that shows information about heating, ventilating, and air conditioning. It is a powerful tool that helps analyze complex systems.

More so, the study found that training on detailed drawing for construction projects and plot/floor plan showing the building's location and outside electrical wiring by technical drawing lecturers. The finding is in line with the recommendation made by Ozen (2007) that these drawings are often a set of detailed drawings used for construction projects: are based on the floor and reflected ceiling plans of the architect: and modern working drawings are much more detailed and it is standard practice to isolate each view on a separate sheet. And also, complete set of working drawings for the average electrical system in large projects according to John and Dale (2004) usually consists of a plot plan showing the building's location and outside electrical wiring.

The study also found that lectures needs training on power-riser diagrams showing panel

board and control wiring diagram and Graphical representation of parts. This finding is in line with finding of Anderson (2007) that drafters need training to prepare wiring and layout diagrams used by workers who erect, install, and repair electrical equipment and wiring in communication centers, power plants, and electrical distribution systems, and buildings. The study also found that explanatory notes, descriptive title, forms, dimensions and construction on the drawing. Corresponding this finding Alan (2007) found that working drawings must include all the knowledge for the production of a machine or structure explicitly so that no further information is needed to complete the production. And also that, the description given by the set of working drawings will include explanatory notes on the individual drawings, giving the specifications of material, heat treatment, and surface finish.

The study found that lectures needs training on illustrations showing how parts fit together and three orthographic views of a system. This finding is in line with recommendation made by Ralph (2009) that an assembly drawing is a technical drawing that uses action illustrations to show how parts fit together and typically includes three orthographic views of the system: overall dimensions, weight and mass, identification of all the components, quantities of material, supply details, list of reference drawings, and notes and detail how certain component parts are assembled. The study also found that lectures needs training on complete presentation of product or structure and note explaining the needed operation and dimensions for the alignment or location of the pieces. The finding concise with the recommendation made by Ralph (2009) and Kyvik (2009) that assembly drawings is a complete presentation of the product or structure put together, showing all parts in their operational positions and the separate parts come to the assembly department after their manufacturing processes are finished and include a note explaining the needed operation and give the dimensions for the alignment or location of the pieces.

The study found that lectures require training on tracing from the design layout, unit assembly drawing and outline drawing. These findings corresponds with the view of Ching (2005) that Several different methods can be used to

produce assembly drawings; the simplest one tracing from the design layouts and that the assembly drawing is produced from the dimensions of detail drawings if the accuracy of checking is considered. And also, a unit assembly as recommended by Padurean and Margen (2009) is a drawing of a related group of parts and used to show the assembly of complicated machinery for which it would be practically impossible to show all the features on one drawing. Additionally, outline assembly drawing as recommended by French (2008) describe the exterior shape of a machine or structure, so it contains only the primary dimension; made for catalogs or illustrative purposes, dimensions are often omitted and includes all the necessary information for producing a machine or structure on one drawing.

The study found that lectures require training on reference letters and numbers representing different parts, tabular assembly drawing and preparation of bill of material (BOM), standardized drawing and an exploded view drawing. These findings are in line with the finding of Basant and Agraup (2013) that in all the assembly drawings, a bill of material is prepared which is a tabulated list placed either on the assembly drawing or on a separate sheet. Basant & Agraup outlined some type of drawings that are related to assembly drawing. These include tabular drawing, standardized drawing and exploded drawing. Further elaborate that, tabular drawing, either assembly or detail, is one on which the dimension values are replaced by reference letters, and an accompanying table lists the corresponding dimensions for a series of sizes of the machine or part, thus one drawing serves for a range covered.

CONCLUSION

Frequent organization of in-service training needed by technical drawing lecturers will in no amount measure lead to effective instruction of metal work and building technology concepts at the tertiary institutions. It is necessary that the lecturers of technical drawing in tertiary institutions should acquaint themselves with the training for efficient imparting of knowledge.

RECOMMENDATIONS

Based on the findings of the study, it is recommended that all the governmental and non-governmental organizations that take charge of tertiary institutions offering metal work and building technology should be fully engage in organizing in-service training for technical drawing lecturers.

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