

Identification of Topics of Difficulty in the Technical Drawing Curriculum by Electrical and Electronics Students in the Technical Colleges in Rivers State, Nigeria

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Abstract: The Purpose of the study was to identify topics perceived as difficult by Electrical and Electronics Trades Students in the study of Technical Drawing Curriculum in the four Government Technical Colleges in Rivers State. To achieve this, survey design was employed. The Population of the study was 216 final year students of Electrical and Electronics Trades Classes of 2017/2018 Academic Session. The Instrument for data gathering was a questionnaire which items were replicated from the current Advanced National Technical Certificate (ANTC) Curriculum of the National Board for Technical Education (NBTE). To guide the study, two research questions and a null hypothesis were formulated. Mean, standard deviation and z- test statistics were adopted to analyze the data. The results showed that both the students of Electrical Trade and Electronics Trade perceived the Curriculum of Technical Drawing as moderately difficult, although more than 25% of the topics were perceived as very difficult. It was recommended that students' interest and motivation should be considered paramount in the teaching and learning of Technical Drawing by both the Electrical Trade and Electronics Trade students in the Technical Colleges. Other recommendations included to provide adequate technical drawing instrument (tools and materials) and conducive learning environment. In addition, Technical Drawing teachers were recommended to acquire industrial skills and Information and Communication Technology (ICT) to enable them acquire relevant skills in the use of Computer Aided Drafting and to link classroom work with industrial practices. The Curriculum of Technical Drawing should direct more attention on applications and field practices.

Keywords: Technical drawing curriculum, drawing difficulty, electrical trade, electronics trade, Technical Colleges

1. Introduction

There are five public technical colleges, out of which four are owned and sponsored by Rivers State Government. These Technical Colleges offer Technical and Vocational Education and Training (TVET) programmes. The Federal Government of Nigeria, National Policy on Education (2004) refers TVET as those aspects of the educational studies covering general education, technologies and related sciences and the acquisition of practical skills, attitudes, and understanding and knowledge relating to occupations in various aspects of economic and

social life. The National Policy on Education, also states that TVET programme implementation covers the following occupational options: Automobile, Building, Electrical and Electronic, Metal Work, and Woodwork Technology. Generally, the aim of the TVET Programme Curriculum is to provide trained manpower in the Applied Sciences and Business, particularly at craft and technical skills- oriented areas. Technical education under which TVET finds itself plays a vital role in human resource development of the country by creating saleable skilled manpower, enhancing industrial productivity and improving the general quality of life. In compliance to this, each of the four Technical Colleges in Rivers State offers Electrical trade and Electronics trade among others. The electrical and electronics trades, according to Oguanya, Akintonde and Bakare (2017) were designed to meet the needs of craftsman that will undertake installation, repair work and servicing electrical/electronic appliances, such as cassette players, radio, television and general electrical wiring and installation in industry as well as residential electrical repairs. The electrical and electronics crafts College graduates, may also wish to take the opportunity to further their education in the Polytechnics (NBTE/ 2001).

A national Curriculum is adopted in all the technical colleges accredited by the National Board for Technical Education (NBTE). The programmes are offered at two levels of certification, leading to the award of the National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC). for craftsmen and advanced craftsmen respectively.

In each of the craftsmen's levels, the study of technical drawing (TD) is made compulsory for all the technical programme curricula, including the electrical and electronics curricula, Technical Drawing is an art or science of representing objects or forms on a flat sheet, chiefly by means of lines; using a variety of tools and techniques. Agrawal and Agrawal (2014) explain that technical drawing is made to provide exact geometrical configurations for the construction or analysis of machines, structures, or systems. It is a form of graphic illustration made according with the standard conventions for layout, nomenclature, interpretation, appearance, size, etc. The

knowledge, skills and habits acquired in Technical Drawing practice enable the young engineer, technologist or craftsmen to:

Create ideal sketches, calculate stresses, analyze motions, size the parts, specify materials and production methods, make design layout and supervise the preparation of drawings and specifications that will control the numerous details of production, assembly and maintenance of product (Giesecke, Mitchell, Hill & Dygdon, 2002).

Beside the direct values to be acquired from a serious study of Technical Drawing, there are a number of very important training values which according to Giesecke, et al (2002) are regarded as byproducts. These are neatness, speed, and accuracy, which are considered basic habits that every successful technologist and scientist must acquire. Electrical and Electronic graduates of Technical Colleges need these knowledge, skills and habits. Such graduate needs to work on building, machines and other installations. If the graduate must succeed in his/her chosen careers, he/ she should be able to draw and interpret exploded and assembly diagrams found in sales manuals, read precision measuring tools, add dimensions. With all these expositions, the question now is how good the students in electrical and electronics trades are in technical drawing in the Technical Colleges in Rivers State.

To answer the above question, a pilot study of performance of final year students in ANTC Technical Drawing in the two Government Technical College in 2015/2016 academic year was carried out by the researcher. The survey found out that the results of the Electrical and Electronic students in technical drawing NABTEB examination were not only poor but lagging behind those of the Mechanical Trades and Building trades. A review of related literature on past studies on the phenomenon as it affect Technical Drawing also showed dearth of empirical reports and data, in particular with respect to the situation in Technical Colleges in Rivers State and Nigeria at large. And where they exist, they are in other subjects as shown in (Elom, 2014; Fabiyi, 2017; Olubukola, 2015 & Jack, Danjuma & Abdul-Kabir, 2017). This observation calls for an urgent need for this research.

2. Purpose of the study

The main purpose of the study was to identify the areas of difficulty in the learning of technical drawing as perceived by Electrical and Electronic trades' students in Technical Colleges. To achieve this purpose, the following objectives have been stated;

1. To identify the levels of difficulty in the topics of Technical Drawing as perceived by Electrical Trade students in the Government Technical Colleges in Rivers State.
2. To identify the levels of difficulty in the topics of Technical Drawing as perceived by Electronics Trade students in the Government Technical Colleges in Rivers State.

3. Research questions

The following research questions were raised to guide the investigation

- What are the levels of difficulty identified in the topics of Technical Drawing as perceived by Electrical Trade students in the Government Technical Colleges in Rivers State?
- What are the levels of difficulty identified in the topics of Technical Drawing as perceived by Electronics Trade students in the Government Technical Colleges in Rivers State?

4. Hypothesis

The following null hypothesis has been formulated for testing at 0.05 level of significance:

H O. There is no significant difference in the mean responses of students of Electrical Trade and Electronics Trade regarding their perceived levels of difficulty in the topics of technical drawing in the Government Technical Colleges in Rivers State.

5. Methodology

The design adopted for the study was descriptive survey research. The 261 final year students of the Electrical Trade and Electronics Trade of the four Government Technical Colleges of the 2017/2018 academic session constituted the population of the study. It was a census study since the entire population which was manageable was used. The Government Technical Colleges are located at Ahoada, Ele-Ogu, Port Harcourt and Tombia.

The instruments used for data gathering were observation and questionnaire. The questionnaire was a four-point rating scale of Likert format of Very Difficult (VD) 4-Points, Moderately Difficult (MD) 3-Points, Less Difficult (LD) 2-Points and Not Difficult (ND) 1-point, was used to rate each item. The items were derived from the Advanced National Technical Certificate (ANTC) Curriculum. The questionnaire also included unstructured format to enable the respondents make additional comments on the availability of drawing tools, materials and environment friendly. Information collected on this section enable the researcher makes appropriate suggestions. The questionnaire was validated by experts in teaching Technical Drawing at Rivers State University. The reliability of the questionnaire was determined through a pilot survey which data (i.e. number of items on the questionnaire, standard derivation and mean of the distribution) were subjected to Kuder Richardson's formula 21, to have a reliability estimate of 0.813.

The copies of the questionnaire were administered and retrieved by the researcher with the assistance of the Head of Department of the affected classes were analyzed using mean, standard deviation and z-test statistics at 0.05 level of significance. The acceptance or rejection of the null hypothesis depended on the z-calculated value and the z-critical value of

Table 1

Mean response showing the levels of difficulty in the topics of technical drawing as perceived by Electrical Trade students in the Government Technical Colleges in Rivers State

S. No.	Topic	N	\bar{X}	SD	Remark
1.	Drawing Definitions, Identification/ Use of Material Tools.	164	2.34	1.16	LD
2.	Board Practice	164	2.76	1.01	MD
3.	Safe Working Habits	164	2.21	1.08	LD
4.	Lines and Line Work	164	2.99	1.16	MD
5.	Angles	164	1.87	0.98	LD
6.	Triangles	164	2.21	1.16	LD
7.	Circles and Triangles	164	2.19	1.07	MD
8.	Quadrilaterals	164	2.74	1.02	MD
9.	Polygons	164	2.89	1.01	MD
10.	Scales	164	2.79	1.10	MD
11.	Enlargement and Reduction of plain figure	164	3.41	0.77	MD
12.	Equal areas of Similar Figures	164	3.66	0.47	VD
13.	Tangents and Tangency	164	2.97	1.02	MD
14.	Special Curves	164	3.80	0.54	VD
15.	True Lengths and Surface Development	164	3.66	0.51	VD
16.	Dimensioning Techniques	164	2.24	1.15	LD
17.	Isometric Drawing	164	3.44	0.83	MD
18.	Oblique Drawing	164	3.00	1.01	MD
19.	Introduction to Computer Graphics	164	3.67	0.74	VD
	Grand Mean		2.92	0.94	MD

Table 2

Mean response showing the levels of difficulty in the topics of Technical Drawing as perceived by Electronics Trade students in Government Technical Colleges in Rivers State

S. No.	Topics	N	\bar{X}	SD	Remark
1.	Drawing Definitions, Identification/ Use of Material Tools.	97	2.27	1.17	LD
2.	Board Practice	97	3.02	1.02	MD
3.	Safe Working Habits	97	2.64	1.14	MD
4.	Lines and Line Work	97	3.08	1.16	MD
5.	Angles	97	1.70	0.91	LD
6.	Triangles	97	2.09	1.23	LD
7.	Circles and Triangles	97	3.27	1.05	MD
8.	Quadrilaterals	97	3.04	0.88	MD
9.	Polygons	97	3.81	0.46	VD
10.	Scales	97	3.35	0.79	MD
11.	Enlargement and Reduction of plain figure	97	3.30	0.75	MD
12.	Equal areas of Similar Figures	97	3.84	0.37	VD
13.	Tangents and Tangency	97	3.67	0.59	VD
14.	Special Curves	97	3.84	0.51	VD
15.	True Lengths and Surface Development	97	3.92	0.28	VD
16.	Dimensioning Techniques	97	3.94	0.24	MD
17.	Isometric Drawing	97	3.54	0.80	VD
18.	Oblique Drawing	97	3.69	0.58	VD
19.	Introduction to Computer Graphics	97	2.41	2.41	MD
	Grand Mean		3.18	0.81	MD

1.96. If the z- calculated value was greater than the z-critical value, the hypothesis was rejected. Otherwise, the alternative hypothesis was upheld.

6. Research questions

1. What are the levels of difficulty identified in the topics of technical drawing as perceived by Electrical Trade students in the Government Technical Colleges in Rivers State?

Table 1 shows a grand mean of 2.92 on the level of difficulty in the topics of technical drawing as perceived by Electrical Trade students in the Government Technical Colleges in Rivers State. The criterion mean level of difficulty as perceived by the

students was 2.50. The result showed that Grand mean (2.92) was above the criterion mean (2.50), and the Grand mean value of 2.92 falls within the range of moderately difficult. Therefore, the result showed that Electrical Trade Students perceived the topics of Technical Drawing as moderately difficult.

Research Question 2

What are the levels of difficulty in the topics of Technical Drawing as perceived by Electronics Trade students in the Government Technical Colleges in Rivers State?

Table 2 above shows that the Electronics Trade students perceived the topics of Technical Drawing as moderately difficult with a grand mean value of 3.18 which was above the criterion mean value of 2.50.

Table 3

Z- test of difference between mean response of Electrical Trade students and Electronics Trade students regarding their perceived levels of difficulty in the topics of Technical Drawing in the Government Technical Colleges in Rivers State

S. No.	Trade	No. of Respondents	\bar{X}	SD	df	z-calc	Z-crit	Decision
1	Electrical	164	2.92	0.93	259	2.95	1.96	Reject H0
2	Electronics	97	3.25	0.79				

Significant ($P < 0.05$)

Hypothesis

HO: There is no significant difference in the mean responses of students of Electrical Trade and Students of Electronics Trade regarding their perceived levels of difficulty in the topics of Technical Drawing in the Government Technical Colleges in Rivers State.

Table 3 above shows the values of z-calculated and z-critical at 0.05 level of significance and with 259 degree of freedom. Guided by the decision rule to reject the null hypothesis if z-calculated value is greater than the z-critical, otherwise do not reject the HO. It was therefore concluded that the difference in the perception of students of Electrical Trade and Electronics Trade was statistically significant. This simply means there was a significant difference in the mean perception of the students of Electrical Trade and Electronics Trade regarding their perceived levels of difficult in the topics of Technical Drawing curriculum in the Government Technical Colleges in Rivers State.

7. Discussion of finding

The study succeeded in shading light in identifying topics perceived by students as difficult in the Curriculum of TD in the Technical Colleges. The finding of the study revealed that out of the 19 items provided in the Technical Drawing Curriculum, three items (1, 5 and 6) only were perceived as less difficult; nine items (2, 3, 4, 7, 8, 10, 11, 16, and 19) as moderately difficult and seven items (9, 12, 13, 14, 15, 17, and 18) as very difficult. It was also derived from the data that the levels of difficulty were higher with the latter items in the orderly arrangement of the curriculum. The results were observed in the table 1 and in table 2 and in both electrical trade and electronics trade showed that majority of the items had mean above the criterion value of 2.50 which in turn suggested that more items were perceived as being more difficult. The finding also showed a number of diverse and staggered perceptions as no cluster of item or topic of difficulty was established. This finding corroborate with Wordu, Ogundu and Amadi (2018).

8. Conclusion

The study concluded that the overall perceived level of difficulty by both Electrical Trade and Electronics Trade students was moderately difficult. The implication is that this level of performance could be reflected in the students' performance in other examinations which require success in technical drawing to qualify for such examinations. It was also concluded that the students perceived more than 50% of the topics as difficult which was a bad signal and calls for serious

and urgent concerns.

Another implication is that a radical action should be taken to improve the qualities of teaching, and integrate e-learning, tools and friendly learning environment, students' interest and pedagogy all should be over hauled for better outcome in learning the subject in the Colleges.

9. Recommendations

Based on the findings, students' responses on the unstructured questionnaire and reviewed literature, the following recommendations were made:

1. The issue of relevance of the subject by both electrical and electronics trade classes should be emphasized in teaching. The motivational phase of instruction should be given adequate consideration. This emphasis will convince students see relevance and applicability of the subject in their present and future career endeavor (Jha, 2014).
2. Students should be confronted with regular projects/ assignments to help them build skills and achieve proficiency in the subject.
3. Teaching should adopt the pedagogical principle of moving from simple to complex. The previous tasks should build on new ones; the lack of graduated or cummulation in the order of difficulties among the topics suggested that the concepts and skills were taught in isolation without a define sequence of how drawing skills should be fitted together and in harmony.
4. Technical drawing teaching and learning should integrate ICT skills. Chedi (2015) recommends that teaching of Technical Drawing should incorporate Computer Aided Design (CAD) software.
5. Teaching of the subject should close the gap between classroom practice and industrial applications to enable students see learning of the subject as a functional endeavour.
6. Technical Drawing studio should be provided with adequate and the state-of-the-arts instructional materials, standardized facilities and comfortable learning environment, better ambient environment will keep students longer for sustained learning
7. Technical Drawing studies and teaching should adopt a blended instruction technique, a combination of e-learning and traditional mode of drawing/ practices. The use of elements of multimedia such as animation has the potent for improving students' attention and sustained interest.

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