PRODUCTION AND UTILIZATION OF INSTRUCTIONAL MATERIALS FOR TEACHING TECHNICAL DRAWING

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ABSTRACT.

This study examined the extent to which technical teachers produced and utilized instructional materials for teaching Technical Drawing. It also identified the problems militating against the production of needed materials. One hundred and sixty-five technical teachers in Delta State were involved in the study. Means, frequencies and percentages were used in analyzing the data. The result showed that instructional materials were not used to teach essential skills.

INTRODUCTION

Technical drawing is a vital subject that is required for the engineering and allied subjects. It is a necessary background to other technical subjects and the study of any technical subject may be difficult without a good knowledge of technical drawing. The knowledge gained from the subject may be used to:

(1) Visualise and understand graphical information and ideas;
(2) Select and use appropriate graphical methods;
(3) Arrange ideas and information systematically and accurately;
(4) Design, reason critically and be creative; and
(5) Acquire basic saleable skills in Building and Mechanical Drawing (West African Examinations Council, 1990).

The subject is taught as part of Introductory Technology in Junior Secondary Schools (JSS) and as a subject at the Senior Secondary School (SSS) level.

Studies have shown that teachers of technical drawing encounter a lot of difficulties developing in the students the sense for shapes, dimensional proportions, spatial perception and method of drawing projections (Okoro, 1990; Agarwal, Mittal and Bhavsar, 1979). Mkpa (1989) recommended the use of real objects in real life situation for instruction. This implies the use of real objects or representations that will be meaningful to the learner. However, instructional materials that may be used in teaching and learning technical courses have been found to be inadequate (Anyakoha, 1992; Odoh, 1990; Mkpa, 1989). These instructional materials are devices which hasten knowledge transfer processes and/or improves the relative depth of understanding of the subject being taught. Nnadi (1989) classified them as:

(1) sophisticated standard instructional materials;
(2) improvised instructional materials; and
(3) semi standard-semi improvised instructional materials.

A way out of the problem of inadequate instructional materials is to procure science and technology educational materials from government-owned science equipment centres. Unfortunately, these centres have their own problems. Osemeikhian (1989) highlighted certain factors militating against optimum production of instructional materials by these centres: They include:

1) Limited capacity and versatility of machinery and equipment;
2) Non-availability of a wide range of raw materials;
3) Public service mentality of some of the workers which sometimes retards the rates at which jobs are executed;
4) Some of their methods tend to be labour-intensive and not suitable for speedy mass production.

An alternative is for teachers to improvise teaching materials. Good enough, the introduction of pre-vocational and vocational subjects into the secondary schools brought about the existence of workshop with basic tools and machinery. Teachers are expected to utilize the workshop facilities for the production of simple teaching aids.

Nnadi (1989) remarked that the use of improvised gadgets can assist in demystifying the unreal "mystery" commonly associated with ready-made or imported equipment. Besides, a well imagined improvisation can lead to the development of patentable standard equipment. He opined that local production of educational materials will have a bright future if teachers and learners are serious about improvisation of simple educational materials while industrial organisations engage in the development and manufacture of sophisticated ones. In realisation of the vital role of the teachers in the production of instructional materials, the National Policy on Education (1981) stated that "teachers will be required to participate more (actively) in the production and assessment of educational materials and teaching aids - and the evaluation of technical innovations and new techniques. These responsibilities make teachers producers and consumers (users) of instructional materials.

The West African Examination Council (1991) advised technical drawing teachers to ensure good understanding and coverage of the topics through practical exposure of their students to real life situations as well as the use of models, charts and other resources materials. The WAEC result showed that for four consecutive years (1988 to 1991) only 38 percent got at least a credit pass in Technical Drawing Examinations in the defunct Bendel State (Now Delta and Edo States). This is an indication of low achievement. This could be caused by a number of factors including poor teaching. Teachers may be faced with the challenges of getting and using instructional materials. There is the need, therefore, to determine the extent of utilization of instructional materials for teaching Technical Drawing.

The study sought answers to the following questions:

1) To what extent do technical teachers produce instructional materials to

teach technical drawing skills;

2) To what extent do technical teachers use improvised materials to teach technical drawing?

3) What are the problems militating against the production of improvised instructional materials?

METHODOLOGY

Population

The population for the study was made up of all technical teachers teaching Technical Drawing in Secondary Schools in Delta State. These teachers were made up of 39 in Technical Colleges and 126 in Secondary Schools. The entire population was involved in the study.

Research Instrument

Questionnaire was the instrument for the study. Ideas and items in the questionnaire were generated from performance objectives stated in the syllabus for Senior Secondary Schools and National Technical Certificate Curriculum and module specifications. Each structured item had a 4-point scale of very often, often, rarely, and not at all; representing 4, 3, 2 and 1 respectively. Teachers were to indicate the frequency with which they produce and utilized instructional material to each of the 22 competencies listed.. The instrument was face and content validated by two vocational educators and one measurement and evaluation expert from Delta State University, Abraka. A pilot test of the instrument was conducted on a sample of fifteen secondary school teachers of Technical Drawing which are not used in the study. The reliability of the instrument was determined using the Cronbach's Alpha (α). The correlation analysis yielded a coefficient of 0.89, indicating that the instrument was reliable.

Data Collection and Analysis

The distribution of the questionnaire and collection of data were carried out by the researcher and four trained assistants who were undergraduate students. One hundred and sixty-five copies of the instrument were distributed by hand and a total of one hundred and fifty-two were completely filled and returned for analysis after a period of two weeks. This represents 92 percent return rate. The data was analysed using frequencies and mean. The first and second research questions were analysed by computing the mean scores for each item on the questionnaire. A cut-off point was determined by finding the mean of the nominal values assigned to the options. Using the interval scale of 0.05 the upper limit of the cut-off point is 2.55 while the lower limit is 2.45. Any response with a mean of 2.55 and above was regarded as a skill where adequate instructional material was used.

Findings

The findings of this study are presented in tables 1, 2 and 3. Research

questions 1 and 2 sought information on the extent to which teachers produce and use instructional materials. Table 1 presents the findings related to the questions.

Table 1; Teachers Response on the Extent to which they produce and utilize instructional materials.

	Xp	Xu
Technical Drawing Skills		
A Geometrical Construction	3.34	3.50
1. Dividing a line into any given scales	2.69	3.11
2. Constructing and reading plane scales	2.91	3.28
3. Reducing or enlarging to scale a given plane figure		
B. Loci	2.43	2.41
4. Constructing ellipse, parabola and hyperbola	2.49	2.36
5. Constructing helix, involute and cycloid curves	2.36	2.30
6. Solving problems involving simple link mechanism		
C. Freehand Sketching	2.28	2.63
7. Making isometric sketches of simple objects	3.48	3.39
8. Making oblique sketches of objects	2.51	2.26
9. Making perspective pictorial sketches of building detail		
D Descriptive Geometry		
10. Locating points and lines in space	1.60	2.01
11. Drawing projected view of inclined lines on principal planes	2.41	2.07
12. Determining the true length of a line in space	2.75	2.91
E. Sectional Views		
13. Drawing of sectional views of cutting planes	2.73	2.91
14. Projecting 1st and 2nd auxiliary plans from normal views	2.10	2.27
15. Projecting 1st and 2nd auxiliary elevation from normal views	2.07	2.10
F. Development		
16. Auxiliary projection of prism out by incline plane	2.05	2.33
17. Development of right and oblique prism	2.24	3.77
18. Development of intersecting hexagonal prism meeting at right angles	1.14	2.07
19. Development of intersecting cylinder	3.82	3.53
G. Machine / Building Drawing		
20. Constructing detailed drawing of machine components	2.41	3.28
21. Constructing detailed drawing of residential building	3.02	3.18
22. Constructing Locking devices	1.28	2.87

Xp = Mean rating of frequency of producing improvised materials
Xu = Mean rating of frequency of utilizing instructional materials
N = 165

From the above table the mean rating of 8 items on the extent to which they produce instructional materials are above the upper limit of 2.55 while 14 items are below the limit. This implies that the respondents did not improvise enough instructional materials for teaching technical drawing. Research question 2 sought information on the extent to which teachers utilized instructional material. The teachers response on the extent to which they utilize instructional materials showed that 12 items are above the upper limit of 2.55 while 10 items are below this limit. This presupposes that more instructional materials were utilised than improvised.

Table 2 showed the teachers responses on the extent of producing and utilizing instructional materials under each major category. The calculated grand means showed that teachers production and utilization of instructional materials were low in major skills like Loci; Descriptive Geometry and Sectional Views. More instructional materials were utilized but not improvised in machine/building drawing cluster.

Table 2: Grand Means of Teachers' Responses on the Extent of Producing and Using Instructional materials for Technical drawing.

	Grand Means		
Technical Drawing Clusters	Xp	Xu	Remarks
A. Geometrical construction	2.98	3.30	High
B. Loci	2.42	2.34	Low
C. Freehand sketching	2.74	2.77	High
D. Descriptive Geometry	2.36	2.33	Low
E. Sectional Views	2.30	2.42	Low
F. Development	3.08	3.90	High
G. Machine / Building Drawing	2.24	3.11	High Utilization

Research question 3 sought information on the problem militating against the production of instructional materials. Table presents the findings related to this question.

Table 3: Teachers' reasons for not producing instructional materials for Technical Drawing

	Frequency N	Percentage Respondents	Rank
1. Teacher bears all the expenses involved	33	20.00	2
2. Materials needed are not available for improvisation	37	22.42	1
3. Many of the instructional aids take a lot of time to produce	30	18.18	3
4. The environment is not encouraging	9	5.45	6
5. Too much labour and problem before finishing.	6	3.64	7
6. Lack of motivation to work	26	15.76	4
7. Local materials that are suitable are expensive	5	3.03	8
8. Lack of resources outside the school community.	11	6.67	5
9. Improvised materials have rough and poor finishing.	4	2.42	9
10 Frustrations associated with Fabrication of parts and tools.	4	2.42	9

From the above table, non-availability of material was ranked first with 22 percent among all other reasons. Three other reasons that followed in descending order are :

(a) Teacher bears all the expenses involved;
(b) Many of the instructional aids take a lot of time to produce; and
(c) Lack of motivation to work.

The least reasons are rough/poor finishing and frustrations associated with fabrication of parts and tools.

DISCUSSION

The findings of this study reveal that many technical drawing teachers have not adequately taught the topics using instructional materials as prescribed by the West African Examination Council. Also, many have not taken active role in the production of instructional materials as stipulated by the National Policy on Education. This is confirmed by the fact that the teachers rarely produce instructional materials for 14 skills out of the 22 skills considered. Ten of the skills are seldom taught using instructional materials. This may be a major cause of poor achievement of students in the technical drawing examinations.

The findings reveal that teachers hardly utilize instructional materials to teach major skill clusters such as Loci, Descriptive Geometry and Sectional Views. In Machine/Building drawing cluster, more technical teachers utilized improvised material than they produced. A possible reason is that the school have improvised or ready made materials and teachers did not need to produce similar ones.

The findings on problems militating against the production of instructional materials reveal that majority of the teachers cannot get the materials needed for improvisation. In such a case, the teachers wants to utilize instructional materials, but they are handicapped. The same argument goes for the fund to procure needed materials. Other reasons advanced by the teachers have been highlighted in a study conducted by Mkpa (1989). This implies that the reasons for not producing instructional aids by technical drawing teachers apply to other subject areas such as arts and science related courses.

CONCLUSION

The findings of this study have important implications for the administrators, the teachers of technical drawing and the students offering technical subjects in schools and colleges. The study has identified the extent to which teachers produce and utilize improvised materials. Based on these, the school administrators will have better understanding of the preparation and utilization of instructional materials in teaching and learning technical drawing skills. If fund is provided to teachers for the needed materials, they are more likely to produce good instructional aids. They also need to be motivated to do the work to the best of their abilities.

Teachers have crucial part to play in the teaching-learning process. The use of instructional materials will increase the rate of learning and save teachers the time and efforts put into teaching for learning to take place. The success of the students in examination will depend, to a large extent, on the ability of the teacher to effectively utilize the instructional materials. If the problems militating against the production of the aids are taken care of, teachers will produce and use the teaching aids and that will improve students' achievement in technical drawing.

It is recommended that the Vocational and Technical division of Ministry of Education should encourage teachers by providing materials needed for improvisation and reward teachers who implement their directives in the classrooms. Further research should be directed toward the extent of improvisation and utilisation of teaching materials needs in Applied Electricity, Electronics, Auto-Mechanics and Building Construction.

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