Development and Evaluation of Task Instructional Sheets for Teaching Electricity/Electronics Skills in Nigerian Colleges of Education

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Abstract
The study was conducted to develop and evaluate task instructional sheets for teaching Electricity/Electronics students in Colleges of Education in Nigeria. Four research questions were formulated guided the study. A pretest and posttest non-equivalent control group design was adopted for the study. A sample of 320 Electricity/Electronics and final year students drawn using random sampling technique from four Colleges of Education in South-South, Nigeria was used for the study. Two schools each were randomly assigned to experimental and control groups and the available data showed that each Electricity/Electronic final year class of each school contains an average of 80 students. The experimental and control groups were taught the (TEE 313) Electricity/Electronics devices and measurement by their regular Electricity/Electronics lecturers. An instrument, the Electricity/Electronics Achievement test (EEAT) was developed by the researchers, validated by three experts and used for date collection. The reliability coefficient of the instrument was 0.85. The results of data analysis showed that the task instructional sheets were superior to the expository method and high ability level students performed better than the low ability level students in Electricity/Electronics. The findings revealed that if the task instruction sheet technique is used for teaching, students will acquire adequate practical skills in the achievement of the assigned tasks. The study further revealed no significant interaction effect of the task instruction sheet and ability level on students' achievement in Electricity/Electronics Technology. Based on the findings of the study, the researchers recommended that teacher educators should encourage their students to use task instructional sheet as it facilitates self-learning and performance of practical tasks during training session. The preparation of task instruction sheets should be incorporated into the curriculum of Colleges of Education and Universities.

Keywords: Task Instructional Sheets, Electricity/Electronics, Skills, Nigeria, Colleges of Education

Introduction

Teachers of Electrical/Electronics technology in Technical Education Programmes are increasingly facing serious instructional challenges as the diversity of students within each classroom continues to widen. These challenges include escalating technology, increase in population, increase in demand for education for work, and individual differences (Obanga, 2015, & Ogwo, 2006). These challenges are as a result of the 6-3-3-4 system of education which aimed at equipping the students with skills and competencies that will make them not

only employable but also to be self-employed (FME, 2008). In pursuance of these challenges of the educational system outlined above, the technical schools and Colleges of Education (Technical) curricula have been restructured to accommodate a number of practical task-oriented courses. Most of the courses in the curriculum are in the fields of science and technology in general and technical education in particular. A list of vocational technical course offerings in technical schools and Colleges of Education include: metal work, woodwork, electricity/electronics, building construction, automobile technology, applied mechanics, technical drawing and others. Petterson (2002) noted that within each classroom students from a wide range of academic levels such as gifted, fast learners, average learners, slow learners and below average face their teachers daily with full hope that their needs will be met. The conventional teaching methods are seriously criticized and adjudged inadequate because they encourage intellectual passiveness and weariness of learners (Ukoha & Eneogwe, 2016).

Task instruction sheet is a type of instructional technique which gives the steps and key point for performing one task. It is also th-e breakdown of performance into detailed levels of specificity. The task sheets may be used in conjunction with a job sheet to assist the learner for more difficult jobs. Thus, it can be thought of as a complete guide to the student in doing a specific job selected by the shop instructor for instructional purposes (Eze, 2007). To this end, task instruction sheet (TIS) technique is a way of instruction whereby a specific skill to be taught is broken into tasks and represented on a sheet with complete instructions to guide the students in the procedure to follow in accomplishing the task. Each task instruction sheet gives complete teaching on a specific skill (Igbo, 2010). The task instruction sheet is self-explanatory but the teacher's guidance is necessary in the process of teaching to put the student through.

Apart from being so efficacious, the task instruction sheet was found free from gender bias by Udofia (1999). However, Harper (2009) and Garba (2003) observed a significant difference between the boys and girls in favour of the girls in one of the task sheet effective scales. Earlier researches on task instruction sheets were on physics (Lugard, 1999), Textile work (Igbo, 2010) and Agricultural Science (Etuk, 2009) for secondary school students. None has been so far developed in Electricity/ Electronics Technology for Colleges of Education students. The present work therefore aimed at investigating the development and evaluation of task instruction sheets on the achievement of electricity/electronics students in Colleges of Education in South-South, Nigeria.

Problem Statement

Available research evidences have shown that faulty instructional techniques are being adopted at the post-secondary school level in teaching Vocational/Technical subjects (Etuk, 2009 & Eze, 2007). According to them, it has been observed that Vocational Education in Nigeria has been predominantly lecture, note-taking and expository in nature. This instructional technique has been badly criticized by educators. The apparently consistent poor achievement in Electricity/Electronics is particularly worrisome as this have been attributed to the poor instructional technique in Electricity/Electronics teaching (Ayara, 2006). This is because the conventional teaching method which is being used in teaching Electricity/Electronics trades does not lay much emphasis on discovery and student self-assessment. This lack of emphasis on discovery and student self-assessment by the conventional teaching method has been identified by researcher as the major problem of learning technical subjects (Effiong, 1996; Lugard, 1999; Eze, 2007 & Ayara, 2006). Some researches (Obodo, 2010 & Udofia, 1999) have blamed the situation on apparent lack of academic ability and effects of gender to study vocational/technical subjects

(Electricity/Electronics) on the part of students. Harper (2006) and Etuk (2000) attributed it to the instructional technique employed by the teachers which have been described as dull, uninterested and ineffective (Lugard, 1999). Perhaps, it is the realization of the need to inject dynamism into vocational and technical education practice in Nigeria (and also lend to improvement in teaching and more effective in reaching goals of education) that has given rise to current researches on the use of innovative techniques to vocational/technical teaching, one of which is task instruction sheet.

The task instruction sheet has been developed and used in subjects such as agricultural, clothing and textile, physics and geography and has been effective in enhancing students' achievement. However, none has so far been developed and used for teaching Electricity/Electronics in Colleges of Education, hence its effect on students' achievement is not known. This has therefore generated a need for a study to develop, validate (evaluate) and use a task instruction sheets in teaching Electricity/Electronics trades at the Colleges of Education so as to determine its effect on students' achievement. Also given the fact that instructional techniques have been found to benefit students of varying academic ability groups differently and which ability group will be more favoured by the use of the task instruction sheet in teaching Electricity/ Electronics Technology in Colleges of Education.

Purpose of the Study

The main objective of this study was to determine the effects of task instruction sheet on the achievement of Electricity/Electronics Technology students in Colleges of Education in Nigeria. Specifically, the study was designed to:

1. Develop and validate (evaluate) task instruction sheet: in Electricity/ Electronics for the teaching of final year NCE students in Colleges of Education.
2. Compare the mean achievement of students taught using task instruction sheets and students taught using the conventional method (Expository).
3. Determine the effect of gender on the mean achievement of students taught with task instruction sheets.
4. Determine the effect of ability level on the mean achievement of students taught with task instruction sheet.

Research Questions

1. How are the developed task instruction sheets rated in terms of their contents, format and utility by lecturers of Electricity/Electronics Technology?
2. What is the difference in the performance of students taught using task instruction sheets and those taught using the conventional method in the Electricity / Electronics Achievement test?
3. What effect does gender of Colleges of Education students have on the mean achievement in the Electricity/ Electronics Achievement Test?

Literature Review

Learning, according to psychologists, is said to occur when there is a relatively permanent change in behaviour. The change in behaviour should be a positive one and it usually comes about as a result of an encounter (or a series of encounters) with some form of experiences (Obanga, 2015). This experience may occur by chance as in everyday life or by design as in the formal school system where the teacher sets a conducive stage to teach effective learning to take place, therefore, the teachers must impart knowledge and skills to the learner

in a manner that the desired impressions are created in the learner. However, some researchers are of the view that a learner can learn a great deals, without a teacher, through individual study, or can learn very little despite the most intensive attention from a teacher depending on internal variables such as interest, purpose, attitude, attention to task and so on (Dilendick, 2015).

In a more popular view, teacher educators presume reasonably that different teaching behaviours influence differently what pupils are able to achieve. That is, there is an assumed causal relationship between skilled teaching and satisfactory learning. This, according to Dilendick (2015) is an instance of process-product paradigm of educational effectiveness and would seem a reasonable justification for the existence of College and University teacher-education course. Commenting on the influence of teacher on the quality of instruction and learning, Effiong (1996) said that the quality of the teacher to a large extent determines the quality of instruction imparted to the students. He further listed the following three components as making up the teacher's quality:

1. The specialist or skill component which concerns the competence in the occupational skill area to be taught.
2. The professional component which concerns the profession competencies of teaching.
3. The general or liberal component which concerns the personal development of the instructor.

Within the professional component, two areas of competence are developed; first, the professional knowledge and understanding relevant to the task of teaching. Secondly, the teaching skills and strategies to be applied within the classroom, laboratory and workshop. In vocational and technical education; these skills and strategies are very essential in assisting students to acquire practical skill competencies. It is on recognition of the above fact that Eze (2007) declared,

> *"Since it is clear that vocational-technical subjects emphasize the acquisition of practical skills, technological knowledge and positive work attitudes, the choice of teaching methods should be such that at the end of the teaching-learning process the learners should be able to demonstrate those competencies which are planned to be developed in these learners".*

Commenting generally on poor skill acquisition by youth, Obodo (2010) said "It is apparent in Nigeria that young people are ill-prepared for entry into the world of work". The general notion therefore is that students' performance in Electricity/Electronics and in other practical oriented trades in our Colleges of Education is poor. It is true that a number of students are knowledgeable in the operating principles and theory of Electricity/Electronics work but they lack the vehicle to translate their knowledge of theory into practices.

Methodology

Design of the Study

Quasi experimental design was used in conducting the study. The non-equivalent control group was adopted. This design entails the use of non-randomize groups when the researcher cannot randomly sample his/her subjects (Ali, 1996). This design was adopted because it is not possible to randomize the subjects of the study without disrupting other school programmes. To answer this research question, a task instruction sheet evaluation questionnaire was developed and administered on five validators. The analysis of their responses is presented in Tables 2 – 3. The structure of this design is outlined in Table 1.

Grouping	Pre-testing	Research condition	Post testing
Group 1 (experimental)	o_1	Treatment (x)	o_2
Group 2 (control)	o_3	No Treatment (-)	o_4

Table 1: The structure of this design.
Where: x = exposed to treatment
o_1 and o_3 for pretests
o_2 and o_4 for post tests
– indicates no treatment (i.e. no treatment for the control group)

Method of Data Analysis

The data generated from the use of the task instruction sheet evaluation questionnaire was analyzed using mean in answering the research questions. Questionnaire items with mean scores of 3.50 and above were regarded as positive or acceptable, while any item with a mean score below 3.50 were regarded as negative and so, rejected. The five-point rating scale provided was scored as follows: 5 - very appropriate, 4 – appropriate, 3 – fairly appropriate, 2 – inappropriate, 1 – very inappropriate.

Analysis of Data

The data collected for this study were statistically analyzed and presented in this chapter. The presentation was arranged according to the research questions.

Research Question I: How are the developed task instruction sheets rated in terms of their contents, format and utility by lecturers of Electricity/Electronics Technology?

Table 2: Mean and standard deviation of the validators' rating of the appropriateness of the content and format of the task instruction sheets

S/No	Evaluation criteria	X	SD	Remarks
1	Comprehensiveness of content	4.20	0.45	Appropriate
2	Specify of instructions in the task instruction sheets	4.60	0.55	Appropriate
3	Accuracy of information on the task instruction sheets	4.60	0.55	Appropriate
4	Readability of the task instruction sheets	4.20	0.45	Appropriate
5	Accessibility of the resources listed in the task instruction sheet	4.80	0.45	Appropriate
6	Appearance of the task instruction sheets	4.60	0.55	Appropriate
7	Overall design of the task instruction sheets	3.60	0.55	Appropriate
8	Length of the task instruction sheets	4.20	0.45	Appropriate
9	Suitability of language used to NCE 3 students	4.80	0.45	Appropriate
10	Appropriateness of the task for the topic relevant to the equipment in the Electrical/ Electronic laboratory	4.00	0.71	Appropriate
11	Appropriateness of the tasks covering the scope of the topic	4.60	0.89	Appropriate
12	Ease of execution of the tasks for NCE 3 students	4.00	0.71	Appropriate
13	Format appeal to a wide audience	4.00	1.00	Appropriate

Table 2 showed that the mean rating of the validators on all the items were above 3.50 with items 5 and 9 having the highest mean rating of 4.80 while item 7 had the lowest mean rating of 3.60. This means that majority of the validators agreed that the content and format of the developed task instruction sheets were appropriate with respect to each of the criteria spelt out on the task instruction sheet evaluation questionnaires.

Table 3: Mean and standard deviation of validators' responses identifying the appropriate would-be users to the task instruction sheets.

S/No	Would-be users	X	SD	Rank	Remarks
14	Technical education teachers	4.20	0.84	5th	Appropriate
15	Electricity/ Electronics teachers	4.80	0.45	1st	Appropriate
16	Technical school Electricity students	4.40	0.55	3rd	Appropriate
17	Craft students and apprentices in electrical establishments	4.00	0.71	8th	Appropriate
18	Individuals with knowledge of electricity	4.00	1.00	8th	Appropriate
19	Students of Electrical technology in Polytechnics	4.40	0.55	3rd	Appropriate
20	Electricity / Electronics students in colleges of Education	4.60	0.55	2nd	Appropriate
21	Teachers who need refresher courses in Electricity / Electronics	4.00	0.71	8th	Appropriate

Table 3 showed that all the listed would-be-users were accepted as appropriate users of the task instruction sheets since each of them had a mean response greater than 3.50. Electricity / Electronics teachers were ranked first while individuals with knowledge of electricity, craft students and apprentices in electrical establishments and teachers who need refresher courses in Electrical/ Electronic technology were ranked last. This means that the task instruction sheets will appeal to many users and not only for Technical lecturers in Colleges of Education.

Research Question 2: What is the difference in the performance of students taught using task instruction sheets and those taught using the conventional method in the Electricity / Electronics Achievement test?

Table 4: Mean and standard deviation of the pre-test and post-test scores of the experimental and control groups in the EEAT

Group		Pre-test	Post-test
Experimental	Mean	25.96	35.66
	N	160	160
	Standard Deviation	4.41	2.17
Control	Mean	25.07	29.60
	N	160	160
	Standard Deviation	4.40	2.69
Total	Mean	25.51	32.63
	N	320	320
	Standard Deviation	4.42	3.89

The data on table 4 showed that the experimental group had a mean score of 25.96 and 35.66 in the pretest and post-test respectively while the corresponding figure for the control

group were 25.07 and 29.60 respectively. This shows that the experimental group had a higher mean score than the control group in both tests. Thus, the difference in the mean score of students taught using task instruction sheets and those taught using the conventional (exposition) method in both pre-test and post-test were 0.89 and 6.06 respectively. This means that the use of task instruction sheets in teaching Electricity/Electronics technology enhances on students mean achievement in the course.

Research Question 3: What effect does gender of Colleges of Education students have on the mean achievement in the Electricity/ Electronics Achievement Test?

Table 5: Mean and standard deviation of the post-test scores of male and female students in the experimental and control group in the EEAT

Sex	Group	Mean	Standard deviation	N
Male	Experimental	35.70	2.23	115
	control	29.62	2.84	117
	Total	32.63	3.98	232
Female	Experimental	35.53	2.02	45
	Control	29.56	2.24	43
	Total	32.61	3.67	88
Total	Experiment	35.66	2.17	160
	Control	29.60	2.69	160
	Total	32.63	3.89	320

The data on table 5 indicated that the mean score of male students taught with the task instruction sheet was 35.70 while that of female students was 35.53. Thus, the mean score of male students was slightly higher than that of the female students. This tends to suggest that the task instruction sheets should improve male students' performance more than that of the females.

Research Question 4: To what extent do the mean score of students taught with the task instruction sheets differ in relation to their ability level?

Table 6: Mean and standard deviation of the post-test scores of low and high ability level students in the experimental and control groups in the EEAT

Group	Ability level	Mean	Standard deviation	N
Experimental	High	36.21	2.14	92
	Low	34.91	1.99	68
	Total	35.66	2.17	160
Control	High	30.60	2.57	90
	Low	28.31	2.26	70
	Total	29.60	2.67	160
Total	High	33.43	3.67	182
	Low	31.57	3.93	138
	Total	32.63	3.89	320

As depicted on table 6, the high ability level students in the experimental group had a mean score of 36.21 with a standard deviation of 2.14 while the low ability level students had

a mean score of 34.91 with a standard deviation of 1.99. Thus, the high ability level students had higher mean score (gain more) than the low ability level students in the post test.

Discussions

The study found that students taught electrical/electronics technology using task instruction sheets had a higher post-test mean score in the EEAT than those taught with the expository method. The analysis of the mean score of the two groups presented on table 9 confirmed that the difference in their scores was statistically significant. This significant difference is attributable to the treatment implying that the use of task instruction sheets in teaching Electricity/ Electronics technology to final year NCE students in Colleges of Education have a positive effect on the student's achievement. The relative superiority of the task instruction sheet technique over the lecture (expository) method could be attributed to the fact that, as an instructional technique, the task instruction sheet technique facilitates active participation of students in the teaching-learning process more than the expository method which often reduces the learners to passive recipients of facts as handed down by the teacher.

Also, in the task instruction sheet technique, the students are presented with a task sheet in which the learning task is broken down into a series of easier but related problems which they must follow. Thus, as they attempt to solve the task through the step-by-step technique, they discover concepts, manipulate objects and equipment and perform tasks with their hands. Their relatively better performance as explained by Conway (1997) is due to the fact that students are more likely to remember concepts they discover on their own more than the ones they are told. Moreover, it is in consonance with the Chinese educational paradigm: I hear, I forget; I see, I remember; I do, I understand, (Ogwo & Oranu, 2006).

The findings of this study on task instruction sheet technique has positive effect on students' performance is in agreement with the result of previous researches carried out by Ajala (2008), Harper (2009), Igbo (2010) and Ezeh (2007) who reported that the task instruction sheets were effective in improving students' performance in their various subjects. These include agriculture, mathematics, home-economics, geography and chemistry. The result of this study however contradicts that of Obodo (2010) and Ozofor (2003) who in their separate studies, found that in the difference performance of students taught with task instruction sheets and the expository methods in mathematics. The difference between the findings of the present study and those of Obodo (2010) and Ozofor (2003) could be due to the fact that the two researchers were unable to effectively solve extraneous variables such as irregular participation of the subjects, inter-group contamination and using teachers with different qualifications and years of experience for the two groups. These factors must have constituted a threat to the internal validity of these studies and could consequently affect their result.

The results of the data analysis with respect to the effects of sex on students' performance revealed that the male students had a slightly higher mean post-test score in the EEAT than the females. This difference was however not high enough to be significant as revealed by the Analysis of Mean. This implies that the task instruction sheet technique is equally favourable to both sexes. The slight superiority of the male students in their post-test mean scores though insignificant could be explained by the fact that electrical/electronics technology being a technical course is mostly preferred by male students than the females. Also, some tasks in the course may be so enervating requiring much muscle power and physical strength which could be easily provided by the males while the females would find such tasks very tedious and energetic and might try to shy away from them.

The findings of this study that there is no significant difference in students' performance as a result of their gender is in agreement with those of Nworgu (2005), Gyuse and Akamseinde (2006), and Balogun (2005) who in their separate studies did not find any significant difference between the performance of male and female students in integrated science. The result also agrees with that of Ogwo (1996) and Udoetuk (2009) who also found that there was no significant difference in cognitive achievement between male and female students in metalwork and introductory technology respectively. The finding of this study that there is no difference in students' achievement as a result of their gender however contradicts the ones earlier made by Maccoby and Nagy (2014) in Lugard (1999) and Olaitan and Ogwo (2006) who found that females performed better than the males. The finding also challenged that of Lugard (1999) who reported that males have greater ability in mathematics while females have greater ability in language and verbal skills as well as that of Igboko (2004) who found that there was a significant difference in the mean score of male and female students taught with the constructivist method in favour of the males. More evidence is still required for any conclusion on sex differences in the use of task instruction sheets.

The analysis of the data for answering research question 4 which sought to find out the difference in students mean scores in the EEAT as a result of their ability revealed that the high ability level students had a mean score of 36.21 in the post-test while the low ability-level students had a mean score of 34.91. This slight superiority of the mean score of high ability level students over that of the low ability level students was however significant as revealed by the Analysis of Mean. Thus, there is significant difference in students mean scores in the EEAT as a result of their ability level implying that the task instruction sheet technique is favourable to all students irrespective of their ability level.

The slight superiority of the high ability level students over the low ability level students, though significant, may be attributed to the fact that since the subjects were classified into low and high ability levels based on their pre-test scores, it is natural that the high ability level students who have more potentials to score higher would try to maintain their position in the post-test. Moreover, the high ability level students would require less effort and time to decode factual information previously encoded in their memory than their low ability counterparts hence they may accomplish a given task or test in less time than their low ability counterparts. However, the significance difference (small difference) in their mean scores is an indication that the task instruction sheet technique is a better instructional technique for both the bright and dull students. The finding of this study that students' ability level is not a significant factor in their achievement in the Electricity/Electronics achievement test is in agreement with Alonge and Agusiobo, 1983; Bornide, 2006; Ezeh, 2007; Njoku, 1997 & Eze, 2001) which show that ability level among other factors exert significant difference in students' achievement in science subjects. The finding however, deviate from the results of previous researches (Balogun, 2015 & Harper, 2009) whose found that the use of prior knowledge of behavioural objective and study questions improve the performance of all students in metalwork irrespective of their ability levels.

Recommendations

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

1. The preparation of task instruction sheets and its usage should be incorporated into the curriculum of teacher preparation programmes in Colleges of Education and Universities.
2. Workshops, seminars and conference should be organized for serving Electricity/Electronics technology lecturers in colleges of education to improve

their knowledge and skills on the development and use of task instruction sheets which have been found in this study to be very effective in promoting students' academic performance.

3. Teacher educators charged with the responsibility of training NCE teachers in technical subjects should encourage their students to use task instruction sheets as it facilitates self-learning and performance of practical tasks during training sessions.
4. Students' active participation in class and self-learning through step-by-step guided approach should always be encouraged among technical education students.
5. Task instruction sheets should be produced in several technical subjects in the form of learning packages or training kits for the teaching of technical subjects as it encourages discovering learning and self-directed learning.
6. Appropriate government ministries and agencies concerned with the provision of facilities and equipment in colleges of education should ensure that all necessary tools, equipment, machines and materials are supplied to the relevant workshops to facilitate effective usage of the task instruction sheets technique.
7. There should be no discrimination in admission in terms of sex or ability level since these factors have been found to have no significant effect on students' academic achievement.

Conclusions

The better performance of students taught with task instruction sheets as against those taught with the lecture or expository method is a pointer to the fact that students' performance can be enhanced through the use of task instruction sheets. This improved performance is due to the positive relationship between academic achievement and students' active participation in class, their interaction with real objects, tools and materials and their performance of practical tasks through a step-by-step guided learning technique. Teachers should therefore be encouraged to break down their lessons into several tasks and sub-tasks, to provide adequate instructions on how each task is to be performed and to allow students to be actively involved in the lesson by performing the tasks themselves. The use of better instructional technique by Electricity/Electronics lecturers in colleges of education, as found in this study, will produce better NCE teachers who are better equipped with adequate intellectual competencies for teaching in our secondary schools. It will also equip them with the necessary practical skills for self-employment. This could undoubtedly reduce the high level of unemployment and poverty in the country.

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