

## *Full Length Research Paper*

# Effect of Three Modes of Teaching on Students' Academic Achievement in Electronics Works in Technical Colleges in Rivers State

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**ABSTRACT:** This study was set out to determine the effect of three modes of teaching on students' academic achievement in electronics works in technical colleges in Rivers State. The study also examined the influence of gender on students' achievement in electronics works. Two research questions and two hypotheses tested at 0.05 level of significance guided the study. The design of the study was pre-test, post-test non-equivalent control group quasi-experimental study. Sample sizes of 174 students drawn from a population of 267 Voc. II students in Rivers State technical colleges were used. To obtain the sample, two technical colleges were purposively selected. Three intact classes were randomly selected and assigned to experimental group 1, experiment group 2, and the control group. The Electronics Works Achievement Test (EWAT) of 30 question items was the instrument developed for the study. The instrument was validated by three experts in technology and vocational

education. A reliability coefficient of 0.67 was obtained using Kuder-Richardson 20 and Pearson's Product Moment Correlation methods. Data collected were analyzed using mean with standard deviation to answer the research questions while analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. It was found that students taught with real instructional resources mode of teaching achieved better in electronics works. Some recommendations were made among which was; workshops/seminars should be organized for electronics works teachers, in order to enable them to use real instructional resources mode of teaching excellently in the classroom.

**Keywords:** Modes, teaching, students, academic, achievement, electronics, works, technical and college

## INTRODUCTION

The provision of quality technical education programme is one of the responsibilities of the government to meet human resource needs of the nation in technology development. Quality technical education trainings are aimed at equipping the learners with useful skills and knowledge in their desired areas of study. Technical education programmes are provided for the learners to have opportunity to acquire the knowledge and practical skills for effective nation building. Technical education according to Nwachukwu (2006) is an aspect of education designed to lead an individual to the

acquisition of practical and applied skills as well as basic scientific knowledge in order to get the individual adequately equipped for self-reliance or employment in the industries. Technical education programmes are offered in technical colleges and other related vocational institutions at post primary level (Nwachukwu, 2006).

Technical colleges according to Okoro (2006) are vocational training institutions in Nigeria that admit junior secondary school leavers to senior secondary schools and provide them with full vocational courses for three years duration. Technical colleges are regarded as the

principal vocational institutions in Nigeria that provide craftsmanship training. They give full vocational training to prepare students for entry into specific engineering trades by offering several subjects that will enable the students' prepare for employment after graduation and one of such subjects is electronics works.

Electronics works in technical colleges involves the repairs, maintenance and construction of basic electronics systems. It enables students in technical colleges to learn basic electronics theory that are needed to understand circuit designs in order to install, operate, maintain and repair electronic systems (Medugu, 2011). According to Robinson (2012) electronics works as a subject also deals with the study of the properties and behaviour of electrons under different conditions, especially with reference to technical and industrial applications. This is because, devices which are used in electronics systems, control the flow of electrons which emanates from atom.

Electronic devices and circuits is one of the branch subjects offered in electronics works. Electronic devices and circuits involve the design and interconnection of electronic components, such as resistors, transistors, capacitors, inductors and diodes, connected by conductive wires or traces through which electrons can flow. The combination of components and wires allows various simple and complex operations to be performed: signals can be amplified, computations can be performed and data can be moved from one place to another (Roy and Rashid, 2012). A proper teaching of the fundamentals of devices and circuits in technical college enhances the performances of students in electronics works and it is offered in vocational II (Voc. II) class (Aneale, 2005).

Electronics works is a skill oriented subject that requires adequate presence and use of instructional resources during teaching and learning processes (Robinson 2012). Aina, (2000) opined that the adequate use of instructional resources in a technical college is the heart of craftsmanship training. This invariably means that instructional resources are very important in technical college training. The lack of adequate use will hinder the acquisition of sufficient practical skills which are the core objectives of the programme. Instructional resources are usually arranged to give occupational direction so that acceptable work habits and procedures are successfully executed.

Moreover, Okujagu (1992) defined instructional resources as those educational apparatus, that are curriculum oriented, audio-visuals, teaching and learning materials and basic tools the teacher uses to assist learners in their learning process. It ensures that the learners see, hear, feel, recognize and appreciate learning, utilizing the five senses modalities at the same time. At all levels of the nation's educational system and for all known and existing school types, instructional resources are indispensable factors in the attainment of set goals and technical colleges will not be an exception.

It is known that, no technical college programme can be functional without instructional resources being utilized during the classroom experience in order to inculcate technology skills for maximum nation's development (Idialu, 2007). According to Akaniwor (2005), instructional resources can be real or improvised.

Real instructional resources are those resources that are ready made; produced by manufacturers for a specific task. In electronics works, real instructional resources are purchased from sellers or gotten from technicians' dumps. However, due to consistent inadequacies in the provision of real instructional resources in the teaching of electronics works in technical colleges; it becomes imperative for technical teachers to think of how best to make use of their creative skills to improvise in order to achieve their lesson objectives.

Improvisation refers to the technique of using materials obtainable from the local environment to produce a product that will serve the purpose of the real one in its absence (Olagunju, 1998). Thus in electronics works; improvisation refers to the use of materials available in the local environment to produce basic electronics systems in the absence of the real ones. This invariably means that when the real instructional resources are not available, improvisation takes their place by producing similar instructional resources that will serve the same purpose. This is to enhance the teaching and learning processes in technical colleges by ensuring that, the persistent problem of inadequacy of instructional resources will not seriously affect the achievement of students.

In the same vein, the real and the improvised are all instructional resources and any can be used in the class for teaching learning process but depending on the subject matter, topic and choice of selection by the teacher (Umunadi, 2009). Umunadi however suggests that using the real instructional resources is more profitable in the class because it has the advantage of being manufactured properly and correctly to suit a teaching and learning process. Udosen and Ekuinam, (2013) are of the opinion that improvised instructional resources can be more profitable in the class since it uses things that are familiar to the students to produce materials that can enhance teaching and learning process. They emphasized that if the students are involved in the improvisation and/or the improvisation of an instructional resource will be done before the students during teaching periods, better impartation can be achieved. In electronics works, the appropriate selection of instructional resources lies on the shoulder of the teacher (Umah and Maaji, 2010). It is the teacher's responsibility to choose either real or improvised instructional resources that will best suit a teaching learning process.

In another development, Towe (2000) and Umar (2002) in their separate studies pointed out that, despite the inevitable need for the use of instructional resources for teaching in technical colleges, the teachers whose

responsibility are seriously lacking in the use of neither the real nor the improvised instructional resources for teaching in technical colleges could lead to very poor students' academic achievement. These according to Umar and Maaji (2010), have become a persistent problem for some years in the technical colleges. Apart from the problem of achievement in relation to real and improvised resources, the issue of gender differences also persists in academic endeavours (Akaninwor, 2005).

Gender is a socially ascribed attribute which differentiate feminine from masculine (Obodo, 2004). It is sex discrimination applied in the education system which affects male and female during and after their education experience. Sex discrimination in technical education, especially in electronics works is in favour of the males. There is a common assumption that technical education is more prone to male students than females as a result of the fact that psychomotor skills are involved to a very high extent (UNESCO, 2004). According to research findings by Jahun and Momoh 2001 and that of Okeke (1996); boys achieve significantly higher than girls in psychomotor skills. Kelley (1999) also reported similar findings in the United Kingdom. Contrary to Okeke's view of boys performing better than girls, Agwagah, (1994) reported that female students performed better than their male counterparts in some science subjects. Odo (1999) in a study reported differential performance between male and female students. The researchers therefore see the need for a teaching mode that might improve the achievement of male and female students in electronics works.

According to Riccards (2013) in education, the academic performances of students in a test or examination is represented by a test score or grade that is usually called students achievement score or grade; or simply achievement. According to Okoye (1997), academic performance is called achievement score because it shows more of the knowledge and skills gained by the student after being taught the course content upon which that examination is based. Nwagu (1992) stated that achievement score shows the degree of attainment of individuals in an academic task, course or programme in which they were sufficiently exposed to.

This problem of students' academic achievement is seen in their performances in various examinations and particularly the National Technical Certificate (NTC) and the National Business and Technical Education Board (NABTEB) examinations. Federal Ministry of Education (FME, 2010) reported that there was a decline in student's academic achievement in electronics works. It stresses that students' achievement in electronics works in technical colleges have been dwindling in recent time and the situation calls for immediate attention in the institutions. FME (2010) stated that technical colleges are expected to produce craftsmen who are highly needed in the industries. According to Aworanti (2011), for some past years till date that electronics works had recorded a

high failure rate of over 50% in National Business and Technical Examination Board (NABTEB). The situation calls for urgent attention in order to avoid a total depletion of students' enrolment in electronics craft trade in technical colleges.

According to Akaninwor (2005), the use of inappropriate modes of teaching is one of the reasons for the failures in technical colleges. Mode of teaching in this context refers to the manner or form of imparting knowledge or skill to learners which includes; conventional instructional resource mode of teaching, improvised instructional resource mode of teaching and real instructional resource mode of teaching. However, Akinfolarin et al.(2012) observed that technical teachers' give more preference to conventional instructional resource mode of teaching over other modes. Hence, it is the view of the researchers that technical teachers' preference for conventional instructional resource mode of teaching over result oriented ones like real instructional resources mode and improvised instructional resources mode in teaching might be a major reason for students' poor academic achievement in electronics works.

Conventional instructional resource mode in this context refers to the use of chalkboard for teaching learning process. It is without the use of real instructional resources or improvised instructional resources (Akaninwor, 2005). It is a talk chalk method of teaching. On the other hand, real instructional resource mode refers to the use of real instructional resources in a teaching and learning process while improvised instructional resource mode refers to the use of improvised instructional resources in a teaching and learning process.

The conventional instructional resource mode of teaching is employed by many electronics works teachers because it enables the teachers to cover a larger content area at a time and the students are given the same content at a time. Besides, this mode of teaching fails to encourage manipulative skill and creative thinking in the learner, hence leading to poor academic achievement of the students. It is regrettable that many electronics works teachers prefer the use of the conventional instructional resource mode which is devoid of the use of neither real instructional resources nor improvised instructional resources. This invariably means, electronics teachers are no longer recognizing the potency of using real instructional resources nor improvised instructional resources in the teaching of electronics works in technical colleges. Hence, the need arises to determine the effect of these three modes of teaching on students' academic achievement in electronics works in technical colleges in Rivers State.

### **Purpose of the study**

The main purpose of the study was to determine the effect of teaching electronics works with real instructional

resources, improvised instructional resources and conventional instructional resources on students' academic achievement in technical colleges in Rivers State. Specifically the study sought to;

- (i) Determine the effect of using real instructional resources, improvised instructional resources and conventional instructional resources modes of teaching on students' academic achievement when taught devices and circuits in electronics works in technical colleges in Rivers State.
- (ii) Determine the effect of using real instructional resources, improvised instructional resources and conventional instructional resources modes of teaching on male and female students' academic achievement when taught devices and circuits in electronics works in technical colleges in Rivers State.

### Research questions

The following research questions guided the study:

- (i) What are the mean achievement scores of electronics works students when taught devices and circuits using real instructional resources, improvised instructional resources as compared with those taught same topic using conventional instructional resources in technical colleges in Rivers State?
- (ii) What are the mean achievement scores of male and female electronics works students when taught devices and circuits using real instructional resources, improvised instructional resources as compared with those taught same topic using conventional instructional resources in technical colleges in Rivers State?

### Hypotheses

The following null hypotheses ( $H_0$ ) were tested at, 0.05 level of significance;

- (i) There is no significant difference in the mean achievement scores of electronics works students when taught devices and circuits using real instructional resources, improvised instructional resources as compared with those taught same topic using conventional instructional resources in technical colleges in Rivers State.
- (ii) There is no significant difference in the mean achievement scores of male and female electronics works students when taught devices and circuits using real instructional resources, improvised instructional resources as compared with those taught same topic using conventional instructional resources in technical colleges in Rivers State.

### METHODOLOGY

This study adopted a quasi-experimental research design. Specifically, the design is a pretest posttest non-equivalent control group quasi experimental group design. The population for the study consisted of 267 Vocational II (Voc. II) students. There are three technical colleges offering Electronics Works in Rivers State which are; Government Technical College Port Harcourt, Federal Science Technical College Ahoada and Government Technical College Tombia. The population for each college was as follows: Government Technical College Port Harcourt, 99 students; Federal Science Technical College Ahoada, 93 students and Government Technical College Tombia, 75 students. The sample for the study consisted of 174 Vocational II (Voc. II) students of Electronics Works, which represents 65% of the population. The sample was obtained using purposive sampling technique to select two technical colleges for the study. There are three intact classes; the researcher randomly assigned these intact classes to experimental group 1 (E1), experimental group 2 (E2) and control group (C) using balloting method. The experimental group 1 had a sample size of 62 students, experimental group 2 had 52 students and control group had 60 students. The technical colleges were co-educational Technical Colleges.

The instrument used for data collection was the Electronics Works Achievement Test (EWAT) which was constructed and developed by the researchers. It is a well-structured test from the content of Electronics Works in the NABTEB syllabus with five items for each selected subject topic. The instrument contained a total of 30 items with four-point multiple choice responses. The development of the instrument was based on a Table of Specification. The instrument was subjected to face and content validation by three experts from technology and vocational education. Their observations were used to improve the instrument in content, grammar, spellings and language. The reliability indices of the instrument was determined by subjecting EWAT to internal consistency and stability using Kuder-Richardson 20 formula and Pearson's Product Moment correlation methods respectively. The average reliability coefficient for both was 0.67, which was considered adequate to be used for the study. The experiment took duration of six weeks and six teachers were involved in the experiment as research assistance. A pretest was given to the students in each group a day before the teaching began using the Electronics Works Achievement Test (EWAT). A posttest was also administered on the sixth week during the revision of all taught topics using the same Electronics Works Achievement Test (EWAT). The Research questions were answered using mean with standard deviation, while the Hypotheses were tested at 0.05 level of significance using one-way and two-way Analysis of Covariance (ANCOVA).

## RESULTS

The analysis of data in relation to each of the research questions and hypotheses are presented as follows;

### Research Question 1

What are the mean achievement scores of electronics works students when taught devices and circuits using real instructional resources, improvised instructional resources as compared with those taught same topic using conventional instructional resources in technical colleges in Rivers State?

Table 1 shows the mean achievement scores of the modes of teaching. From table 1, the posttest mean achievement score of real instructional resources (experimental group 1) was 25.86 with a standard deviation of 2.84. The posttest mean achievement score of improvised instructional resources (experimental group 2) was 23.64 with a standard deviation of 2.96. While the posttest mean achievement score of conventional instructional resources (control group) was 18.59 with a standard deviation of 1.95. The mean achievement score of real instructional resources was higher, followed by improvised instructional resources and then conventional instructional resources followed. This implies that the students taught with real instructional resources achieved highest followed by those taught with improvised instructional resources. Those students taught with conventional instructional resources achieved least.

### Research Question 2

What are the mean achievement scores of male and female electronics works students when taught devices and circuits using real instructional resources, improvised instructional resources as compared with those taught same topic using conventional instructional resources in technical colleges in Rivers State?

Table 2 shows the mean achievement scores of the modes of teaching on gender. From (Table 2), the posttest mean achievement score of real instructional resources (experimental group 1) for male was 24.86 with a standard deviation of 3.18 while the female posttest mean achievement score of real instructional resources (experimental group 1) was 24.13 with a standard deviation of 2.81. The posttest mean achievement score of improvised instructional resources (experimental group 2) for male was 23.64 with a standard deviation of 2.92 while the female posttest mean achievement score of improvised instructional resources (experimental group 2) was 23.17 with a standard deviation of 3.00. The posttest mean achievement score of conventional instructional resources (control group) for male was 18.62 with a standard deviation of 3.94 while the female posttest mean achievement score of conventional

instructional resources (control group) was 16.67 with a standard deviation of 4.06. The mean achievement score of male students was higher when taught with real instructional resources, followed by improvised instructional resources and then conventional instructional resources. Similarly, the mean achievement score of female students was higher when taught with real instructional resources, followed by improvised instructional resources and then conventional instructional resources. This implies that the male students achieved best in the posttest when taught with real instructional resources followed by those taught with improvised instructional resources. The female students achieved best in the posttest when taught with real instructional resources followed by those taught with improvised instructional resources. Male and female students achieved least in conventional instructional resources.

### Hypothesis 1

There is no significant difference in the mean achievement scores of electronics works students when taught devices and circuits using real instructional resources, improvised instructional resources as compared with those taught same topic using conventional instructional resources in technical colleges in Rivers State.

Table 3 shows students achievement with respect to modes of teaching. For modes of teaching, the SPSS computed F – value of 346.880 was found significant at 0.000 level of significance, which is less than the 0.05 level of significance set for the research. Therefore, mode of teaching is significant. The null hypothesis one is rejected. This means that there is a significant different in the mean achievement scores of electronics works students when taught devices and circuit using real instructional resources, improvised instructional resources and those taught same topic using conventional instructional resources in technical colleges in Rivers State?

### Hypothesis 2

There is no significant difference in the mean achievement scores of male and female electronics works students when taught devices and circuits using real instructional resources, improvised instructional resources as compared with those taught same topic using conventional instructional resources in technical colleges in Rivers State.

Table 4 shows students achievement with respect to gender. For gender, the SPSS computed F – value of 26.022 was found significant at 0.021 level of significance, which is less than the 0.05 level of significance set for the research.

**Table 1:** Mean achievement scores with standard deviations due to modes of teaching.

Modes	Pretest		Posttest		N
	Mean	SD	Mean	SD	
Real	2.53	0.98	25.86	2.84	62
Improvised	1.92	0.69	23.64	2.96	52
Conventional	2.40	0.81	18.59	1.95	60

**Table 2:** Mean achievement scores with standard deviations due to modes of teaching on gender.

Modes	Male				Female				Overall			
	Pretest		Posttest		Pretest		Posttest		Pretest		Posttest	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Real	2.51	0.68	24.86	3.18	2.55	0.92	24.13	2.81	2.53	0.80	24.50	2.96
Improvised	1.98	0.86	23.64	2.92	1.86	0.66	23.17	3.00	1.92	0.74	23.41	2.95
Conventional	2.58	0.75	18.62	3.94	2.22	0.80	16.67	4.06	2.40	0.77	17.65	4.01

**Table 3:** One-way ANCOVA on students' achievement due to modes of teaching.

Source	Type III Sum of squares	df	Mean Square	F	Sig.	Dec.
Corrected Model	30.984	6	5.164	28.065	0.000	
Intercept	3919.024	1	3919.024	21299.043	0.000	
Modes	11.764	2	63.826	346.880	0.000	S
Gender	4.788	1	4.788	26.022	0.021	S
Modes and Gender	10.211	2	5.106	27.750	0.000	S
Error	31.096	169	0.184			
Total	5070.000	172				
Corrected Total	83.332	173				

**Table 4:** Two-way ANCOVA on students' achievement due to modes of teaching on gender.

Source	Type III Sum of squares	df	Mean Square	F	Sig.	Dec.
Corrected Model	30.984	6	5.164	28.065	0.000	
Intercept	3919.024	1	3919.024	21299.043	0.000	
Modes	11.764	2	63.826	346.880	0.000	S
Gender	4.788	1	4.788	26.022	0.021	S
Modes and Gender	10.211	2	5.106	27.750	0.000	S
Error	31.096	169	0.184			
Total	5070.000	172				
Corrected Total	83.332	173				

Hence, gender is significant. The null hypothesis two is rejected. This means that there is a significant difference in the mean achievement scores of male and female electronics works students. On interaction for hypothesis three (modes and gender), the SPSS computed F – value of 27.750 was found significant at 0.000 level of significance which is less than 0.05 level of significance set for this research. Hence, the null hypothesis three is rejected. This means, there is a significant difference in the mean achievement score of male and female electronics works students when taught devices and circuit using real instructional resources, improvised instructional resources and those taught same topic using conventional instructional resources in technical colleges in Rivers State.

## DISCUSSION

The study revealed in Research Question 1 that students

taught with real instructional resources (experimental group 1) had a higher mean achievement score in electronics works compared to those taught with improvised instructional resources (experimental group 2) and conventional instructional resources (control group). This is further confirmed in hypothesis 1 by high achievement which indicated that mode of teaching was a significant factor in the achievement of students in the electronics works content. This means that the students who were taught using real instructional resources performed better. The reason for the better performance by real instructional resources may be that the students were able to link the new concepts to relevant ready-made instructional resources. Thus, the result of the study revealed that the adoption of relevant ready-made instructional resources enhances meaningful academic achievement of electronics subjects. This study is supported by Akaniwor (2005) view that students demonstrated greater understanding of technical

education subjects as a result of exposure to the concepts of real instructional resources. This view is at variance with the view of Aina (2000) who believed that with use of equipment manuals, any good students can achieve better with or without real instructional resources.

The study also revealed in Research Question 2 that on average, male and female students taught with real instructional resources achieved better than their counterparts taught with other modes of teaching. However, testing for significance, Hypothesis 3 reveals that the difference in mean achievement of male and female student is significant, which revealed that male students performed better than the females. This result is at variance with Obodo (2004) who noted that there is no significant difference in the mean achievement of male and female students in the sciences. This result is in agreement with the findings of Agwagah (1994), which revealed that male students achieved significantly higher than their female counterparts in mathematics. However, this study showed that in electronics works male students seem to achieve significantly higher than their female counterparts. This could be attributed to the fact that male students seem to love and get more involved in practically oriented subjects than their female counterparts (Agwagah, 1994).

## Conclusion

Conclusion was made based on the findings of the study. The results of the study provided the empirical evidence that the real instructional resources mode of teaching enhanced students' academic achievement better than improvised instructional resources mode of teaching and control resources mode of teaching. This implies that, for an effective teaching that will bring about a better academic achievement in electronics works, real instructional resources mode of teaching should be used. This finding is irrespective of gender. Thus, academic achievement in electronics works is depended on the mode of teaching.

## Recommendations

The following recommendations were made based on the findings of the study:

- (i) Since the use real instructional resources mode of teaching has been found to be effective in facilitating better academic achievement in electronics works content; hence the teachers in electronics works should accept the intricacies and develop a better attitude of using it consistently in every lesson plan.
- (ii) Workshops/seminars should be organized for electronics works teachers, in order to enable them use real instructional resources mode of teaching excellently

in the classroom.

- (iii) State and Federal governments should legally enforce the use of real instructional resources mode of teaching in every electronics works teaching and learning process. This will completely eliminate the use of conventional instructional resources which has been found to be ineffective.

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