

# Effectiveness of a Digital Oscilloscope for the Teaching of Some Radio, Television and Electronics Work Concepts at the Technical College Level in Adamawa State, Nigeria

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## Abstract

The study was conducted to find out the effectiveness of the Digital oscilloscope (D.O.) for the teaching of some Radio, Television and Electronics work concepts at the technical college level. There are two research questions and three null hypotheses formulated to guide the study. The population for the study consisted of 160 students from the four technical colleges that offer RTE, from which 124 students were sampled and randomly assigned to either experimental group or control group. A structured questionnaire titled; 'Researcher made performance test' (RMPT) was used for data collection. RMPT consists of three rating scales. There are 8 skills to be observed and assessed in each rating scale. The draft of the RMPT and table of specification were given to six experts from two universities for validation. The simple mean and standard deviation were used to analyse the data for answering the research questions. Analysis of covariance (ANCOVA) was employed to test  $H_{01}$  to  $H_{03}$ . The findings include; students that were taught using the Digital Oscilloscope had a higher score in the performance test than those taught using traditional oscilloscope. It was recommended that; due to the numerous advantages, which include large screen using data projector for demonstration, easier to operate, portability, among others. All hands must be on deck to see that the digital oscilloscope is purchased by all concerned and used to complement the traditional oscilloscope for teaching not only RTE, but all related areas.

**Keywords:** Digital oscilloscope, Traditional oscilloscope, performance test, Radio Television and Electronics

## 1. Introduction

The poor conditions of instructional materials in our technical colleges have been critically examined by educationists. Awotunde (1999) reported that States and the Federal government have not been able to build workshops nor provide equipment because money was not available and the equipment was too expensive to acquire. Anaele (2000) also reported that instructional materials in technical colleges are substandard and inadequate even where there was evidence of available funding.

The consequences of these conditions on performance of the graduates can be enormous. For instance, Ibe (1994) asserted that poor provision of educational facilities in vocational technical institutions lead to the production of graduates that are half-baked or unproductive. He further, maintained that, memorization and regurgitation of facts become the norm in vocational technical colleges where instructional materials are inadequate. Anaele (2000) also, observed that students in technical colleges are not well exposed to practical work, and this certainly does affect them in their examinations. Specifically, poor performance in technical and vocational subjects need not be overemphasized. Studies by Oluropo (2005) revealed that there is high decline in performance of students in technical colleges.

Table 1: Students' Performance in Radio, Television, and Electronics Work (RTE) in NABTEB Examination 2009-2011, in the North-East Sub-region.

Year	Entry	Candidates who sat for exam.	Credit 1-6	Pass 7-8	Fail 9
2009	220	213 (96.82%)	48 (22, 54%)	73 (34.27%)	92 (43.19%)
2010	249	247 (99.20%)	49 (19.84%)	65 (26.31%)	133 (53.85%)
2011	212	208 (98.11%)	38 (18.27%)	50 (24.04%)	120 (57.69%)

Source: Zonal NABTEB Offices –Maiduguri and Yola

From Table 1, it can be seen that failure in RTE increased from 43.19% in 2009 to 53.85% in 2010 and then rose to 57.69% in 2011. These results are frustrating, to say the least. Among the causes of student's failure in RTE was very poor response to practical questions by candidates (NABTEB, 2009 & 2011) Chief Examiner's report. It is not clear as to whether or not the situation of things will likely be better than this in the nearest future.

John (2000) and Ezugu (2004) maintained that, Nigerian technical colleges in general and Adamawa State in particular have inadequate supply of teaching/learning materials and competent teachers who are willing to teach their students these skills. The North East Geopolitical Zone of Nigeria is not spared of this predicament. The question is, in the light of these inadequacies in technical colleges, to what extent have the goals of the FRN (2004) which includes giving training and imparting the necessary skills to individual who shall be economically self reliant been achieved? Such questions and inadequacies raised concern for the researcher. In an attempt to ameliorate the problem of inadequacy of instructional materials which has been shown to be one of the major factors responsible for persistent failure in RTE, the researcher intends to use and determine the effectiveness of a digital oscilloscope as instructional material that can be used for teaching/learning RTE at the technical college level in Nigeria.

### 1.1 Purpose of the study

- i. Determine whether students taught using Digital Oscilloscope (DO) differ in mean scores from those taught using Traditional Oscilloscope (TO), as measured by Researcher made performance test (RMPT)
- ii. Find out if male and female students taught using DO differ in mean scores from those taught using TO as measured by RMPT

### 1.2 Research Questions

To achieve the purpose of this study, the following research questions were asked:

- a) What is the mean score of students taught RTE, using DO and those taught using TO in a RMPT?
- b) What is the mean score of male and female students taught RTE using DO, and of male and female students taught RTE using TO, in a RMPT?

### 1.3 Hypotheses

Based on the research questions, the following three null hypotheses were formulated and tested at 0 .05 level of significance

HO<sub>1</sub>: There is no significant difference in the mean score of students in treatment group Ge, who were taught RTE with digital oscilloscope and group Gc, who were taught RTE using traditional oscilloscope, as measured by RMPT

HO<sub>2</sub>: There is no significant difference in gender mean effect as measured by RMPT

HO<sub>3</sub>: There is no gender - treatment interaction effect in the students 'performances in the RMPT

## 2. Methods and Materials

The study was undertaken in the North East Geopolitical zone. The zone is located in the Northern part of Nigeria. A total of 124 Part II Radio, Television and Electronics students were randomly drawn from four technical colleges. The colleges were the only college offering RTE trade in the geopolitical zone. The design of the study is pretest posttest control group experimental design. In each college an intact class were individually randomly assigned to either experimental or control group. Two instruments were constructed based on the NBTE (2006) approved curriculum. The instruments were tagged, researcher made pretest (RMP) and researcher made performance test (RMPT). RMP was administered on the students to determine the student's entry behavior and to determine those qualified as sample for the study. It consists of 45 multiple choice items with

four options A – D. Each correct response attracted 2.22 marks; while, RMPT consists of three rating scales; rating scale one was for determining waveforms, has 7 number of sub operations; rating scale two, measurement of voltages, has 5 sub operations and rating scale three, detecting signals, has 3 sub operations. There are 8 skills to be observed and assessed in each rating scale, giving a total of 24 skills. Each sub operation attracts 24 marks. The draft of the instruments were submitted to six experts of varied years of teaching RTE from Modibbo Adama University of Technology, Yola and University of Nigeria Nnsukka for their comments and suggestions. The instruments were later pilot tested at government science and technical college Takum, Taraba State; where 38 students from RTE class were involved in the exercise. The pilot test results produced a reliability coefficients of  $r = 0.78$ .

The instruments consists also of Traditional oscilloscope (TO), a teaching aid supposed to be used for teaching and learning purposes at technical colleges but very expensive and very difficult to find in colleges. Digital oscilloscope (DO); a teaching aid used to teach experimental group. This teaching aid requires the use of computer for it, to work.

Simple mean and standard deviation were used to analyze the data for answering the research questions. Analysis of covariance (ANCOVA) was employed to test  $H_{01}$  to  $H_{03}$ . The pretest scores were used as covariates for performance test scores. A hypothesis was rejected if the calculated F- value is greater than the table value of F at 0.05 probability level; otherwise the hypothesis was accepted if the calculated value is less than the F- value. If the results show significant, the scheffe test was used to determine contrast between pairs of means. If otherwise, then this stage was not necessary

### 3. Results

#### 3.1 Research questions

questions

3.1.1 Research question one: What is the mean score of students taught RTE using DO, and those taught using TO in a RMPT?

Data analysis on Table 1 shows that:

- i) Students Ge (n=62) that were taught using Digital Oscilloscope had a mean of 67.32
- ii) Students Gc (n=62) that were taught RTE using the traditional oscilloscope had a mean score of 53.16 in the RMPT.

Treatment group	N	Mean score %	Min.	Max
Ge (DO)	62	67.32	44.00	81.00
Gc (TO)	62	53.16	37.00	70.00

3.1.2 Research question two: What is the mean score of male and female students taught RTE using DO, and of male and female students taught RTE using TO, in a RMPT?

As shown from the analysis on, Table 2: Male students that were taught with Digital Oscilloscope had a mean score of 70.61 Female students that were taught with Digital Oscilloscope had a mean score of 63.79 Male students in group Gc, had a mean score of 55.34 in the performance test Female students that were taught in the Gc group, had a mean score of 50.83

Table 2: Means score of male and female students in RMPT in RTE

Treatment group	N	Gender	Mean score %	Min.	Max.
Ge	33	Male	70.61	57.00	81.00
	29	Female	63.79	44.00	80.00
Gc	32	Male	55.34	41.00	68.00
	30	Female	50.83	37.00	70.00

#### 3.2 Hypotheses testing

The result of the ANCOVA obtained using statistical analysis for scientist (SAS) version 9.0 is presented in tables 3 to 5.

3.2.1  $H_{01}$ : There is no significant difference in the mean score of students in treatment group Ge, who were taught

RTE with digital oscilloscope and group Gc, who were taught RTE using traditional oscilloscope, as measured by RMPT

From table 3, F- Value for treatment is 67.86 with significant probability of 0.0201, which is less than 0.05. This shows that the effect of treatment on performance mean scores is significant. The hypothesis is therefore, rejected. To determine if the differences in the obtained mean is significant, the researcher conducted a post-hoc analysis using scheffe test. Table 4, shows, group Ge had 67.32p%, group Gc had a mean score of 53.52%. The test has shown that the group means of Ge and Gc are significantly different, since they have different grouping letters, A and B in favour of group Ge.

3.2.2 *HO<sub>2</sub>*. There is no significant difference in gender mean effect as measured by RMPT

Analysis on table 3, shows that F-value for gender effect during the performance test is 15.82 with significant probability of 0.0001, which is less than 0.05. Thus the test is significant at 5% probability, so the hypothesis is rejected. This means, there is significant difference in gender mean effect during the performance test. Scheffe test was used to determine the direction of the significant difference in the two means. Analysis on Table 4, shows that females had 57.48%, while male had a higher mean of 63.09%. The scheffe grouping letter for both gender groups is A for male and B for female. It means the differences in their mean are significant, in favour of males.

3.2.3 *HO<sub>3</sub>*. There is no gender - treatment interaction effect in the students' performances in the RMPT

ANCOVA test result on Table 3, further shows that F-value for gender and treatment interaction during the performance test is 1.43, at a significant probability of 0.33, which is greater than 0.05. Therefore the hypothesis is accepted. This means, there is no significant interaction effect of gender and methods of treatment during the performance test.

Table 3: ANCOVA test result of treatment effects on RMPT and gender interaction

Sources	SS	DF	MS	F-Value	P > F
Pretest	223.52	1	555.67	7.33	0.0455
Gender	901.09	1	901.09	15.82	0.0001
Treatment	7654.76	1	3427.37	67.86	0.0201
Gender*treat.	81.28	1	71.28	1.43	0.33
Explained	6890.69	3	2296.90	40.33	0.0001
Error	6833.50	120	56.95		
Corrected total	13724.19	123			

Table 4: Scheffe analysis of means for treatment in groups Ge and Gc in RMPT

Treatment	No. of students	Mean%	Scheffe grouping
Ge	62	67.32	A
Gc	62	57.48	B

0.0201 < 0.05

Table 5: Scheffe analysis of means according to gender in RMPT

Gender	No. of students	Mean%	Scheffe grouping
Male	65	63.09	A
Female	59	57.48	B

0.0001 < 0.05

3.3 Findings of the study

a) Total of 62 RTE students attempted the RMPT, in the DO group, they had 67.32% mean score, 62 RTE students also attempted the RMPT, in the TO group, and they had 53.16% mean score. It was observed that, those in group DO had higher percentages.

b) In the DO group, 33 male and 29 female RTE students attempted RMPT. The male had a mean score of 70.61, while the female had a mean score of 63.79%. This means the male performs better than their female colleagues in this group. In the TO group, 32 male and 30 female RTE students attempted RMPT. The male had mean score of 55.34% while the female had a mean score of 50.83%. It implies, male had a higher mean score than female in this group.

c) There is significant difference in the mean score of students in treatment group Ge, who were taught RTE with digital oscilloscope and group Gc, who were taught RTE using traditional oscilloscope, as measured by RMPT

d) There is significant difference in gender mean effect as measured by RMPT

e) There is no gender - treatment interaction effect in the students' performances in the RMPT

#### 4. Discussion of Findings

The results on Table 1 imply that, the students in the experimental group that were taught with the Digital Oscilloscope obtains higher percentage of mean score (67.32%) in performance test than their counterpart in the control group who were taught RTE using the Traditional oscilloscope with just 53.16%. This result is similar to that of Vero, Garcia and Pedro's (2006) and Osuagwu (2006) who all maintained that, students that were taught with Digital instruments performs better in the performance test than the Real instruments. The reasons could probably be, because the Digital instrument provides quick and easy switching between instruments as outlined by Pico tech (2008). The results in Table 7, show that, male had a higher percentage in the Ge group (70.61% male and 63.79 for female). On the Gc side, although, their performance had dropped compared to that of the Ge, but the male has higher percentage of 55.34% and female has 50.83%. Even though, female students had higher maximum score of 70% than that of the male students of 68%. These differences, where male performs better in both Ge and Gc could be as a result of the boys were more computer literate than the girls and some of the boys were radio and television technicians. Similar reason has been cited by researchers such as Osuagwu (2006) and Vero et al (2006). They maintained that students that are computer literate are better than their counterpart when it comes to working with software that requires computer usage.

This results shows that, those that were taught using DO are better, in performance than those that were taught using TO. The results explain that between the two teaching aids (DO and TO), DO have greater influences in improving students performance. This finding is supported by researchers such as Vero et al (2006) and Osuagwu (2006) who all indicated that significant differences existed in the performance of students who were taught with DO materials, and those with traditional materials in favour of the digital oscilloscope materials. This may be due to the fact that the DO is easier to operate and has a larger screen. In other words the finding demonstrated the superiority: DO have over the TO as opined by Linke etal (2003), Fletcher (2007) and Pico Tech (2008).

The above results show that, significant differences existed in the mean score of male and female in RMPT. The result implies that DO has influence on students performance. The reason for this observed behavior, might have stemmed from the experience male students have on the operation of computer, which most of the girls claimed that, that was their first time to use computer. To properly use a computer software or hardware requires knowledge of computer. Those who are more experience in computer operation tend to perform better when working with computer software (Iheamacho, 1997). The Table further presents the result for gender and treatment interaction during the performance test. The F-value is 1.43, at a significant probability of  $0.33 > 0.05$ . This led to the rejection of hypothesis 3, meaning, there is no significant interaction effect of gender and methods of treatment during the performance test.

ANCOVA test result of  $H_0$  showed that, there is no significant gender treatment interaction effect. This means, given the treatment, gender did not affect how subjects learned RTE with the DO. This is an interesting finding of this study. It has given clue to an effective tool that can be used to reduce gender bias in teaching RTE, thereby providing a level ground for both genders to learn the subjects.

#### 5. Conclusion

This study examined the effectiveness of a Digital Oscilloscope (DO) compared to Traditional Oscilloscope (TO), when they are used to teach two different groups of Radio, Television and Electronics work (RTE) students at the science and technical college level. The purpose was to determine if DO would be effective to teach RTE students at the science and technical colleges. The second purpose was to determine whether the DO would help the RTE students to retain what they have learnt longer.

#### 6. Recommendations

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

- i) Generally, male performed better in the Ge (DO) group than the female; the probable reason was that males are more literate in computer than their female colleagues as confessed by some of the female students. Female students should be encouraged, both at home and in school to be computer literate.
- ii) Due to its numerous advantages, which include large screen using data projector for demonstration, easier to operate, portability, among others. All hands must be on deck, to see that the Digital Oscilloscope is purchased by all concerned and used to complement the Traditional Oscilloscope for teaching not only RTE, but all related areas.
- iii) Workshop should be organized at the technical college level to introduce the use and the importance of Digital

Oscilloscope to practicing teachers. Such workshop should emphasize the various attributes of the digital Oscilloscope, which can be exploited for educational advantage.

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