

1 Impact of using Simulink in Matlab on Students' Academic  
2 Achievement and Gender in Electronics Works Trade in Technical  
3 Colleges of Adamawa State, Nigeria

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7 **Abstract**

8 This study explored the impact of using Simulink in MATLAB on Students' Academic  
9 Achievement and Gender in Electronics Works Trade in Technical Colleges of Adamawa State,  
10 Nigeria. The study adopted quasi-experimental design. Two research questions and two  
11 hypotheses guided the study. The population of the study was made up of all NTC students  
12 offering Electronics works Trades course in Adamawa state Technical Colleges. Purposive  
13 sampling was used to select 52 NTC II students offering Electrical Works Trade from Yola  
14 South and Numan Technical colleges. The instrument for data collection named Electronics  
15 Works Trade Achievement Test (EWTAT); was constructed, validated and used for the study.  
16 The reliability of EWTAT was determined using Pearson Product Moment Correlation  
17 Statistic (PPMCS) and it yielded 0.70. Mean statistics was used to answer the two research  
18 questions and t-test statistic techniques was used for testing the null hypotheses at 0.05 level  
19 of significance. findings of the study revealed that using Simulink in MATLAB was more  
20 effective for teaching Rectifier circuits in Electronics Works Trade than when Lecture Method  
21 was used.

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23 **Index terms**— MATLAB, simulink, simulation, academic achievement and electronic technology.

24 **1 Introduction**

25 apid Technology advancement in the modern society cannot be separated from the advancement in electronic  
26 technology. The world has turned into an age where modern industry finds application of electronics technology  
27 very essentials. Most firms rely on Electronics technology for designing, constructing and maintaining industrial  
28 machines (Ogbuanya and Owodunni, 2015). Application of Electronic technology helps Companies to reduces  
29 cost and increases productivity, the application of the Electronics technology requires experts to implement  
30 and monitor the automation and analysis of manufacturing process. Growth and development in the field of  
31 electronic industries have created a strong demand for employees who are well trained, experienced and up to  
32 date in knowledge (Ogundokun, 2010). This job area requires graduates with good problem-solving skills, critical  
33 thinking abilities, and computer skills, among others. Electronic Technology technicians/craftsmen are trained  
34 at various levels of education system, both formal and informal, these include: Technical colleges, Colleges of  
35 education, Polytechnics, and Universities. Others are Government and Nongovernmental skills acquisition centers  
36 (Okoro, 2006). According to Federal Republic of Nigeria (FRN), (2013) the Course of study offered at Technical  
37 colleges that prepare its recipient to become Electronics Technology Technician/Craftsmen is Electronics Works  
38 trade.

39 Electronics works trade in one the courses in engineering trades offered in Nigerian's Technical colleges in which  
40 at the completion of three years or one year advanced programme, the graduates are awarded National Technical  
41 Certificate (NTC) and Advanced National Technical Certificate (ANTC) for the craft level and advanced level  
42 respectively FRN, (2013). The programme of Electronics work trade is designed to produce competent craftsmen  
43 and technician, who could be employed, be self-reliant and also, able to proceed to higher education. According

## 1 INTRODUCTION

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44 to National Board for Technical Education (NBTE), (2010), graduates of electronics works trade are expected  
45 to be able to test, diagnose, services and repair any fault relating to electronics unit and system based on  
46 manufactures' specification. The syllabus of Electronic works trade at NTC level according to NBTE, (2015)  
47 was based on the following modules; Electrical/Electronic drawing, General metal work 1, Electronics devices  
48 and circuits, Radio communication, Radio and audio frequency amplifier, Satellite transmission and reception  
49 and Television. The modules were further broken to suptopics such as: Diodes, bi polar junction transistors  
50 (BJT)/Field effect transistors (FET), and common circuit configurations including clippers, clamps, amplifiers,  
51 active filters, regulators, power amplifiers, differential amplifiers and operational amplifiers and Rectifier circuit,  
52 among others. The Rectifier circuits was considered and selected as the topic for the experimental. The modules  
53 and the topics are designed as a guide toward the attainment of the objectives of Electronic works trade at  
54 Technical college level.

55 The realization of the objectives of Electronic works trade in Technical colleges, which include production of  
56 qualified craftsmen and technicians that can carry out repairs and maintenance of faulty electronics appliances and  
57 also further their education, depends on a number of factors. These include; the availability of equipment, tools  
58 and materials, an adequate supply of qualified technical education teachers and the method of teaching employed  
59 in delivering the teaching and learning. At present, in Adamawa state's Technical colleges, the Electronics  
60 works students were taught with the traditional teaching method, which is mostly the lecture and demonstration  
61 methods ??Oyebolu & Lemu, 2013).

62 Teaching and learning are very important element in Technical Education, the teacher uses different methods  
63 and materials to teach their students. There are various strategies for teaching electronics works trade which  
64 range from the use of lecture, discovery, inquiring, demonstration and problem solving among others (Usman,  
65 2010). Mostly, teachers uses lecture method for teaching.

66 The lecture method is a teacher centered method where by, the teacher does most of the talking (Usman,  
67 2010). This lecture method used by teachers to teach in technical colleges reduces the ability of the students  
68 to grasp relevant concepts rather than when they are exposed to lessons involving hand-on experience. Ishaku,  
69 (2019) observed that students are not interested in technical courses because of the apparent non-motivational  
70 methods and approach used by some of the teachers. Moreover, Nuruddeen (2013) opined that, the learning of  
71 electronics technology should be based on teaching materials, variety of teaching methods and dynamic approach.  
72 Students learn through observation and doing, which signifies hands on and minds on theories, learners could be  
73 introduced to the phenomena of nature which surround them through the use of fascinating learning materials  
74 that will make them to be exploratory in nature.

75 The development of technology from day to day is providing better alternatives to the ways and means by  
76 which teaching and learning was previously carried out. Traditionally, in electronic technology, forming large  
77 models of systems have been via a mathematical model derived from related circuit theory, which attempts to  
78 find analytical solutions to problems and thereby enable the prediction of the behavior of the system from a set of  
79 parameters and initial conditions. It is important to note that with new technologies such as the use of computer  
80 aided designs and software packages. learning nowadays can be facilitated through different computer Aided  
81 Instruction (Software) other than the traditional teaching and learning method ??Hassan and Musa, 2020).

82 Software-supported educational products are some of the innovative technologies designed to be used in the  
83 computer-based and computer supported teaching practices. Such technologies can be used as complementary  
84 materials for doing calculations, and preparing simple models and simulations (Traynor, 2003) It can also be used  
85 as a teaching material in the teaching of a part of a subject or the whole subject. Teaching software is capable of  
86 reducing the problems encountered in education (Ahmet and Ahmet, 2008). Science and technical programmes,  
87 students need to be encouraged to learn not only through their ears, but should be able to use their eyes and  
88 hands to watch and manipulate tools/equipment (Traynor, 2003). The use of Simulink in MATLAB could be a  
89 way out of the problem of lack of instructional materials for effective teaching of electronics works trade.

90 MATrix LABoratory (MATLAB) is a software that can be used to analyze, synthesize, organize, and evaluate  
91 contents and gathered data in schools and industries. Marcov, (2009) observed that the use of circuit simulation  
92 software such as MATLAB provides change in teacher's role from that of giver of information and adviser to that of  
93 facilitator and modeler. This provides technology-rich environment to motivate interest and enhance achievement  
94 of electronic learners. Xenophontos (1999) noted that MATLAB is a high-level computer language and interactive  
95 environment for numerical computation, technical data analysis, programming, simulation and visualization. He  
96 further stressed that it can be a valuable tool for teaching courses in technology. With MATLAB, data can  
97 be analyzed, algorithms developed, and models and applications created. It has a language, tools and inbuilt  
98 mathematical functions which can enable the exploration of multiple approaches to reach solutions faster than  
99 with spreadsheets or traditional programming languages. According to Jarumi (2016) MATLAB can be used  
100 for a range of applications, including signal processing, communications, image and video processing, control  
101 systems, test and measurement computations among others through the use of simulation.

102 A simulation is a situation in which a particular set of condition is created artificially in order to study or  
103 experience something that could exist. In electrical technology, circuit simulation is a technique that can be  
104 used to predict the behavior of a real circuit using a computer program. Simulation is a computer program that  
105 predict the behaviour of a real circuit. It replaces real components with idealized electrical models which allows  
106 measurements of internal currents, voltages and power that in many cases are virtually impossible to do any

107 other way (Jarumi, 2016). Simulation processes are done in a Simulink, which is a software incorporated in to  
108 MATLAB (Ogundokun, 2010).

109 Simulink is a software imbedded in MATLAB, it provides a block diagram tool for modeling and simulating  
110 dynamical systems, including signal processing, controls, communications, and other complex systems. The  
111 products of Simulink are used in a broad range of industries, including automotive, space technology, electronics,  
112 environmental, telecommunication, computer peripherals, finance and medical (Ogundokun, 2010). Simulink also  
113 has a large collection of tool boxes for variety of applications. A tool box consists of functions that can be used to  
114 perform some computations in the toolbox domain. It can therefore be an invaluable tool for improving students'  
115 achievement in electronic technology courses (Jarumi, 2016). Instrument of lesson delivery is of great importance  
116 in achievement as observed by Nurudeen (2013) who stated that the methods and tools employed by a teacher  
117 to teach the lesson could influence students' learning interest as well as academic achievement.

118 Academic achievement denotes knowledge and skills attained by students in school or institution. According  
119 to Usman (2010) academic achievement is always denoted by a score which represent the amount of learning  
120 acquired, knowledge gained or skills and competencies in the subjects. ??assan and Musa (2020) viewed Academic  
121 achievement as a measure of the student's academic standing in relation to those of other students of his age.  
122 Academic achievement is the exhibition of knowledge attain or skills developed by learners in a course of study.  
123 It is the measure of results test scores administered to learners (Jarumi, 2016).

124 Students' academic achievement can be influenced by their gender. There are gender differences in learning in  
125 Science, Math, Engineering and Technology. Jarumi (2016) conducted a study on using MATLAB Simulation,  
126 she found that, there is no much differences in the mean achievement of male and female students. Ogwo (1996)  
127 conducted a study on the effects of meta-learning instructional strategies on students' achievement in metal work  
128 technology and reported that male students had slightly higher mean scores than the females, which was not  
129 considered significant. The inconclusive nature of research findings on gender and achievement in technology  
130 makes it imperative to find out the impact of the software Simulink in MATLAB. It is hoped that the use of  
131 Simulink in MATLAB may help ease some of the difficulties students of electronics faced due to the abstract  
132 nature of the subject and, complex mathematical models involved and also bridge the gender gap. The package  
133 can be used in creating a virtual lab or workshop to help students appreciate practical operations of phenomena  
134 they otherwise would have imagined. Various studies (Hassan and Musa, 2020; Jarumi, 2016) have associated  
135 improved learning performance with the use of computer assisted instruction, and their claims that, the quality  
136 of learning can be significantly enhanced when ICT is integrated with teaching motivated the need to embark on  
137 this study.

## 138 **2 II.**

### 139 **3 Statement of the Problem**

140 Graduates of technical colleges in Adamawa state according Ishaku, (2019) were unable to establish themselves  
141 by taking up a carrier from their trades of specialization, neither proceed to higher institutions, they end up  
142 as Keke Napep riders, Taxi driver, Political tugs and other diverse social vices like Shila boys. Lack of courage  
143 by graduates of technical colleges to set up a business in their area of discipline could be attributed to lack  
144 of acquisition of required skills during training. This shows that efforts of Government, Teachers and resources  
145 invested is a waist ??Hassan, 2016). Checkmating the underperformance of Technical college graduates according  
146 to Ogbuanya and Owodunni (2015) require the assessment of the teachers' quality, teaching methods and required  
147 training facilities. The prevalence uses of Lecture method my contribute to the ineffective teaching and learning  
148 (Abdul-Aziz, 2013). According to him the lecture method of teaching is the "Talk and chalk" approach. The  
149 method is teacher centered and the student remain passive. Consequently, the students are not able to obtain  
150 and apply their learning to new situation and this makes them apathetic and repulsive to learning. This method  
151 may as well may impede the acquisition of requisite skills.

152 Similarly, NABTEB, 2010 Chief examiner says that the students' low academic performance was particularly  
153 due inappropriate methods and techniques used by teachers, lack of qualified and competent teachers, lack of  
154 available and up to date standard facilities and material and lack of commitment on the side of the students.  
155 It is due to the continuous decline in the performance of students of technical colleges in Adamawa state the  
156 researcher aimed to assess the Impact of Simulink in MATLAB on Students' Academic achievement and Gender  
157 in Electronics Works Trade in Technical Colleges of Adamawa State, Nigeria.

### 158 **4 a) Purpose of the Study**

159 The general purpose of this study was to investigate the Impact of Using Simulink in MATLAB on Students'  
160 Academic Achievement in Electronic works Trade in Technical Colleges of Adamawa state, Nigeria. Specifically,  
161 the study sought to:

162 1. Compare the mean achievement scores of students taught using Simulink in MATLAB and those taught with  
163 lecture method. 2. Determine the influence of gender on achievement of students when taught using Simulink in  
164 MATLAB.

165 **5 b) Research Questions**

166 The following research questions were answered in the study: 1. What is the difference between the mean posttest  
167 scores of students taught Rectifier circuit using Simulink in MATLAB and those taught with lecture method? 2.  
168 What is the influence of gender on achievement of students when taught using Simulink in MATLAB?

169 **6 c) Hypotheses**

170 The following hypotheses were formulated to guide the study and were tested at 0.05 level of significance: H0 1 :  
171 There is no significant difference in the achievement scores of students taught using Simulink in MATLAB and  
172 those taught with the lecture method. H0 2 : There is no significant difference in the achievement of male and  
173 female students taught using Simulink in MATLAB.

174 **7 III.**

175 **8 Methodology**

176 The research design employed for this study was Quasi-experimental design, with emphasis on posttest non-  
177 equivalent control group. The study involved the use of experimental and control groups. The population  
178 of the study consisted of all NTC students offering Electronics works trade at state Government owned  
179 Technical colleges in Adamawa state. Purposive sampling was used to select NTC II student from Yola south  
180 and Numan LGAs. The sampled students were made off Fifty-two (52) students (Male=39, Female=13). Thirty  
181 (30) students were assigned to experimental group while twenty-two (22) students were assigned to control  
182 group. One instrument was developed by the researcher to generate data for this study. The instrument was  
183 named Electronics works trade Achievement Test (EWTAT), it has forty (40) items, adapted from NABTEB  
184 pass questions of (2015-2019). The students were freely allowed to select the correct answers and each correct  
185 answer was assigned a mark while the overall mark was forty (40) marks. The EWTAT drafted was validated  
186 by two experts in field of Electronics Technology Education at Modibbo Adama University Yola. The EWTAT  
187 was pilot-tested on a sampled student having same characteristic with the groups in different schools in Gombe  
188 State. The split half method (odd-even) was used to test the reliability of scores on thirty (30) students. Pearson  
189 Product Moment Correlation Statistic (PPMCS) was used to determine the reliability of the EWTAT, and the  
190 instrument yielded a reliability coefficient (r) of 0.70. For the purpose of data collection, the following sequential  
191 steps were used. The students were subjected to the treatment using the planned Lesson plan, then followed  
192 by post-test by the researcher through the use of EWTAT to obtain information from the students. The data  
193 were collected after marking the students' answer scripts. The scores were computed into experimental and  
194 control groups. Thereon, the scores collected from tests were recorded, calculated and subjected to data analyses  
195 respectively. The data collected were analyzed at two different levels, via descriptive and inferential levels. At  
196 the descriptive level, the descriptive statistics of mean and standard deviation were used to respond to research  
197 questions. While at the inferential level, the t-test analysis was used to test the null hypotheses at the significance  
198 level of  $? = 0.05$ . The inferential statistics level formed the basis to permit decision making on whether to reject  
199 or retain the null hypotheses after being tested.

200 IV.

201 **9 Results**

202 Research Question One: What is the difference between the mean posttest scores of students taught using  
203 Simulink in MATLAB and those taught with Lecture method? The result from Table 1 shows that, from the  
204 mean of experimental group 23.27 and that of control group 13.91, there is a mean difference of 9.36 between  
205 the mean academic achievement scores of students taught Rectifier circuit using Simulink in MATLAB and those  
206 taught using Lecture Method. This proves that, the experimental group had mean score greater than that of the  
207 control group. This establishes the evidence that, the treatment had improved students 'Achievement in Rectifier  
208 circuit positively.

209 Research Question Two: What is the influence of gender on achievement of students when taught using  
210 Simulink in MATLAB? Result from Table 2 calibrates that, based on the mean of male group 19.98 and that  
211 of female group 19.03, there is mean difference in male and female students of 0.95. This establishes that, the  
212 treatment had promoted the performance of both male and female students in Rectifier Circuit significantly.

213 **10 V. Hypotheses**

214 Hypothesis One: There is no significant difference in the achievement scores of students taught using Simulink in  
215 MATLAB and those taught using Lecture method. Table 3 indicates a significant difference between the mean  
216 academic performance scores of students taught Rectifier Circuits using Simulink in MATLAB and those taught  
217 with Lecture Method;  $t (98) = 28.6$ ,  $P = 0.01$ . With  $P < 0.05$  the result suggests a difference in students'  
218 achievement after being exposed to Simulink in MATLAB and Lecture method. Therefore, hypothesis one is  
219 rejected.

220 Hypothesis Two: There is no significant difference in the achievement of male and female students taught using  
221 Simulink in MATLAB. The result from Table 4 revealed that there is no significant difference between the mean

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222 performance scores of male and female students taught Rectifier circuit using Simulink in MATLAB;  $t$  (48) =  
223 1.96,  $P = 0.06$ . With  $P > 0.05$  the difference between the mean performance scores of male and female students  
224 exposed to treatment is not significant. Hence, the hypothesis is accepted.

## 225 **11 VI.**

## 226 **12 Discussion**

227 The result from research question one showed that, there is significant difference between the mean academic  
228 achievement scores of students taught Rectifier circuits using Simulink in MATLAB and those taught using  
229 Lecture Method. The experimental group therefore, achieved significantly greater than the control group. The  
230 hypothesis one was rejected which revealed that there is significant difference in the mean scores of both  
231 experimental group and control group therefore, the finding was in accordance with the finding of Hassan  
232 and Musa (2020) which indicated that Computer Assisted Instruction significantly influenced the performance  
233 Electronics works students in Resistor color coding. This is also agreed with the findings of Ogbuanya and  
234 Owodunni (2015) who found that the Reflective Inquiry Instructional Techniques is more effective than the  
235 Traditional method. The result from the research question two indicated that, there is no much difference between  
236 the mean academic achievement scores of male and female students taught Rectifier Circuit using Simulink in  
237 MATLAB. In addition, male and female students exposed to Simulink in MATLAB did not differ significantly.  
238 While the second hypothesis was upheld, this revealed that there is no significant difference in mean scores of  
239 male and female when taught with Simulink in Matlab. It was generalized that Simulink in MATLAB was found  
240 to be gender friendly which is in accordance with the findings of Jarumi (2016) which showed that, the use of  
241 MATLAB Simulation in teaching Electronic Technology proved to be effective in enhancing the performance of  
242 male and female students, he further stated the the approach is gender friendly.

## 243 **13 VII.**

## 244 **14 Conclusion**

245 Analysis of the result portrayed that; the experimental group achieved statistically better as a result of the  
246 exposure to treatment that is using Simulink in MATLAB. It is evidence that, Simulink in MATLAB is effective in  
247 enhancing learners' academic achievement, it also indicated that, teacher-centered method of delivery instructions  
248 may be the reason for low performance and failure of students to response NABTEB questions effectively in  
249 Electronics Works Trade. This also showed that, the lecture method commonly used by teachers in secondary  
250 schools is not quite suitable for effective teaching and meaningful learning of Electronics works trade concepts  
251 and Rectifier circuit in particular, because the lecture method is not a student-centered approach. The exposure  
252 of male and female students to the treatment implied that, the two subjects gained actively from the treatment.  
253 This indicates that, the treatment is suitable for both male and female students meaning that, is gender friendly  
254 and not bias.

## 255 **15 VIII.**

## 256 **16 Recommendations**

Based on the findings of this study, the researcher recommended that:

1

Group	N	MEAN	SD	Mean Difference
Experimental Group	30	23.27	7.09	9.36
Control Group	22	13.91	5.02	

Figure 1: Table 1 :

## 16 RECOMMENDATIONS

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2

Variable/Group		N	Mean	SD	Mean Difference
Experimental Group	Male	22	19.98	9.34	
	Female	8	19.03	7.81	0.95

Figure 2: Table 2 :

3

Group	N	Mean	SD	df	t	p	Remark
Experimental Group	30	41.3	10.7	50	28.6	0.01	Significant
Control Group	22	32.1	7.3				

Figure 3: Table 3 :

4

Group	N	Mean	SD	df	t	p	Remark
Male	22	29.26	4.3	28	1.96	0.06	No Significant
Female	8	28.25	4.1				

Figure 4: Table 4 :

Simulation approach in teaching Technical subjects such as Electronics works trade.

3. Stakeholders in education, Non-governmental Organizations Association (

(NGO)arenTeachers‘

Figure 5:

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