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Abstract- This study explored the impact of using Simulink in MATLAB on Students` Academic Achievement and Gender in Electronics Works Trade in Technical Colleges of Adamawa State, Nigeria. The study adopted quasi-experimental design. Two research questions and two hypotheses guided the study. The population of the study was made up of all NTC students offering Electronics works Trades course in Adamawa state Technical Colleges. Purposive sampling was used to select 52 NTC II students offering Electrical Works Trade from Yola South and Numan Technical colleges. The instrument for data collection named Electronics Works Trade Achievement Test (EWTAT); was constructed, validated and used for the study. The reliability of EWTAT was determined using Pearson Product Moment Correlation Statistic (PPMCS) and it yielded 0.70. Mean statistics was used to answer the two research questions and t-test statistic techniques was used for testing the null hypotheses at 0.05 level of significance. findings of the study revealed that using Simulink in MATLAB was more effective for teaching Rectifier circuits in Electronics Works Trade than when Lecture Method was used.

Keywords: MATLAB, simulink, simulation, academic achievement and electronic technology.

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Impact of using Simulink in Matlab on Students` Academic Achievement and Gender in Elctronics Works Trade in Technical Colleges of Adamawa State, Nigeria

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Abstract- This study explored the impact of using Simulink in MATLAB on Students` Academic Achievement and Gender in Electronics Works Trade in Technical Colleges of Adamawa State, Nigeria. The study adopted quasi-experimental design. Two research questions and two hypotheses guided the study. The population of the study was made up of all NTC students offering Electronics works Trades course in Adamawa state Technical Colleges. Purposive sampling was used to select 52 NTC II students offering Electrical Works Trade from Yola South and Numan Technical colleges. The instrument for data collection named Electronics Works Trade Achievement Test (EWTAT); was constructed, validated and used for the study. The reliability of EWTAT was determined using Pearson Product Moment Correlation Statistic (PPMCS) and it yielded 0.70. Mean statistics was used to answer the two research questions and t-test statistic techniques was used for testing the null hypotheses at 0.05 level of significance. findings of the study revealed that using Simulink in MATLAB was more effective for teaching Rectifier circuits in Electronics Works Trade than when Lecture Method was used. The study also found that the use of Simulink in MATLAB promoted the performance of both the male and female significantly. It was generalized that Simulink in MATLAB was found to be more effective and gender friendly. It was recommended among others that; State Ministry of Education should encourage teachers on the use of Simulink in MATLAB for teaching Electronics Works Trade. Seminar, workshop and Conference should be organized for Technical teachers on how to use the Simulink.

Keywords: MATLAB, simulink, simulation, academic achievement and electronic technology.

I. Introduction

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

Electronics works trade in one the courses in engineering trades offered in Nigerian`s Technical colleges in which at the completion of three years or one year advanced programme, the graduates are awarded National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) for the craft level and advanced level respectively FRN, (2013). The programme of Electronics work trade is designed to produce competent craftsmen and technician, who could be employed, be self-reliant and also, able to proceed to higher education. According to National Board for Technical Education (NBTE), (2010), graduates of electronics works trade are expected to be able to test, diagnose, services and repair any fault relating to electronics unit and system based on manufactures` specification. The syllabus of Electronic works trade at NTC level according to NBTE, (2015) was based on the following modules; Electrical/Electronic drawing, General metal work 1, Electronics devices and circuits, Radio communication, Radio and audio frequency amplifier, Satellite transmission and reception and Television. The modules were further broken to sup-topics such as: Diodes, bi polar junction transistors (BJT)/Field effect transistors (FET), and common circuit configurations including clippers, clamps, amplifiers, active filters, regulators, power amplifiers, differential amplifiers and operational amplifiers and Rectifier circuit, among others. The Rectifier circuits was considered and selected as the topic for the experimental. The modules and the topics are designed as a guide toward the attainment of the objectives of Electronic works trade at Technical college level.

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

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

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

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

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

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

A simulation is a situation in which a particular set of condition is created artificially in order to study or experience something that could exist. In electrical technology, circuit simulation is a technique that can be used to predict the behavior of a real circuit using a computer program. Simulation is a computer program that predict the behaviour of a real circuit. It replaces real components with idealized electrical models which allows measurements of internal currents, voltages and power that in many cases are virtually impossible to do any other way (Jarumi, 2016). Simulation processes are done in a Simulink, which is a software incorporated in to MATLAB (Ogundokun, 2010).

Simulink is a software imbedded in MATLAB, it provides a block diagram tool for modeling and simulating dynamical systems, including signal

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

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

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

II. Statement of the Problem

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

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

a) *Purpose of the Study*

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

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

b) *Research Questions*

The following research questions were answered in the study:

1. What is the difference between the mean posttest scores of students taught Rectifier circuit using

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Simulink in MATLAB and those taught with lecture method?

2. What is the influence of gender on achievement of students when taught using Simulink in MATLAB?

c) Hypotheses

The following hypotheses were formulated to guide the study and were tested at 0.05 level of significance:

$H0_1$: There is no significant difference in the achievement scores of students taught using Simulink in MATLAB and those taught with the lecture method.

$H0_2$: There is no significant difference in the achievement of male and female students taught using Simulink in MATLAB.

III. Methodology

The research design employed for this study was Quasi-experimental design, with emphasis on post-test non-equivalent control group. The study involved the use of experimental and control groups. The population of the study consisted of all NTC students offering Electronics works trade at state State Government owned Technical colleges in Adamawa state. Purposive sampling was used to select NTC II student from Yola south and Numan LGAs. The sampled students were made off Fifty-two (52) students (Male=39, Female=13). Thirty (30) students were assigned to experimental group while twenty-two (22) students were assigned to control group. One instrument was developed by the researcher to generate data for this study. The instrument was named Electronics works trade Achievement Test (EWTAT), it has forty (40) items, adapted from NABTEB pass questions of (2015-2019). The students were freely allowed to select the correct answers and each correct answer was assigned a mark while the overall mark was forty (40) marks. The EWTAT drafted was validated by two experts in field of Electronics Technology Education at Modibbo Adama University Yola. The EWTAT was pilot-tested on a sampled student having same characteristic with the groups in different schools in Gombe State. The split half method (odd-even) was used to test the reliability of scores on thirty (30) students. Pearson Product Moment Correlation Statistic (PPMCS) was used to determine the reliability of the EWTAT, and the instrument yielded a reliability co-efficient (r) of 0.70. For the purpose of data collection, the following sequential steps were used. The students were subjected to the treatment using the planned Lesson plan, then followed by post-test by the researcher through the use of EWTAT to obtain information from the students. The data were collected after marking the students` answer scripts. The scores were computed into experimental and control groups. Thereon, the scores collected from tests were recorded, calculated and subjected to data analyses respectively. The data collected were analyzed at two different levels, via descriptive and inferential levels. At the descriptive level, the descriptive statistics of mean and standard deviation were used to respond to research questions. While at the inferential level, the t-test analysis was used to test the null hypotheses at the significance level of $\alpha = 0.05$. The inferential statistics level formed the basis to permit decision making on whether to reject or retain the null hypotheses after being tested.

IV. Results

Research Question One: What is the difference between the mean posttest scores of students taught using Simulink in MATLAB and those taught with Lecture method?

Table 1: Mean and Mean Difference of Electronics works Trade Achievement Scores for the Experimental and Control Groups

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

The result from Table 1 shows that, from the mean of experimental group 23.27 and that of control group 13.91, there is a mean difference of 9.36 between the mean academic achievement scores of students taught Rectifier circuit using Simulink in MATLAB and those taught using Lecture Method. This proves that, the experimental group had mean score greater than that of the control group. This establishes the evidence that, the treatment had improved students 'Achievement in Rectifier circuit positively.

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Research Question Two: What is the influence of gender on achievement of students when taught using Simulink in MATLAB?

Table 2: Comparison of Mean Scores of Male and Female Students in Experimental

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

Result from Table 2 calibrates that, based on the mean of male group 19.98 and that of female group 19.03, there is mean difference in male and female students of 0.95. This establishes that, the treatment had promoted the performance of both male and female students in Rectifier Circuit significantly.

V. Hypotheses

Hypothesis One: There is no significant difference in the achievement scores of students taught using Simulink in MATLAB and those taught using Lecture method.

Table 3: T-test Analysis on Academic Achievement of Students for Experimental and Control Groups

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				

Table 3 indicates a significant difference between the mean academic performance scores of students taught Rectifier Circuits using Simulink in MATLAB and those taught with Lecture Method; $t\ (98) = 28.6$, $P = 0.01$. With $P < 0.05$ the result suggests a difference in students` achievement after being exposed to Simulink in MATLAB and Lecture method. Therefore, hypothesis one is rejected.

Hypothesis Two: There is no significant difference in the achievement of male and female students taught using Simulink in MATLAB.

Table 4: T-test Comparison on Academic Performance of Male and Female Students in Experimental Group

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				

The result from Table 4 revealed that there is no significant difference between the mean performance scores of male and female students taught Rectifier circuit using Simulink in MATLAB; $t\ (48) = 1.96$, $P = 0.06$. With $P > 0.05$ the difference between the mean performance scores of male and female students exposed to treatment is not significant. Hence, the hypothesis is accepted.

VI. Discussion

The result from research question one showed that, there is significant difference between the mean academic achievement scores of students taught Rectifier circuits using Simulink in MATLAB and those taught using Lecture Method. The experimental group therefore, achieved significantly greater than the control group. The hypothesis one was rejected which revealed that there is significant difference in the mean scores of both experimental group and control group therefore, the finding was in accordance with the finding of Hassan and Musa (2020) which indicated that Computer Assisted Instruction significantly influenced the performance Electronics works students in Resistor color coding. This is also agreed with the findings of Ogbuanya and Owodunni (2015) who found that the Reflective Inquiry Instructional Techniques is more effective than the Traditional method. The result from the research question two indicated that, there is no much difference between the mean academic achievement scores of male and female students taught Rectifier Circuit using Simulink in MATLAB. In addition, male and female students exposed to Simulink in MATLAB did not differ significantly. While the second hypothesis was upheld, this revealed that there is no significant difference in mean scores of male and female when taught with Simulink in Matlab. It was generalized that

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Simulink in MATLAB was found to be gender friendly which is in accordance with the findings of Jarumi (2016) which showed that, the use of MATLAB Simulation in teaching Electronic Technology proved to be effective in enhancing the performance of male and female students, he further stated the the approach is gender friendly.

VII. Conclusion

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

VIII. Recommendations

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

1. Annals of Technology Education Practitioners Association of Nigeria (ATEPAN), Technical Teachers, NBTE and research centers like Nigerian Educational and Research Development Council (NERDC) and National Teachers` Institute (NTI) should incorporate the use of Simulink in MATLAB approach in science and Technology curricula as well as delivery instructions at technical colleges.
2. Seminars, workshops and conferences should be organized by Technical education board, NBTE, ETF and NERDC in order to train Technical teachers on effective implementation of the use of MATLAB` Simulation approach in teaching Technical subjects such as Electronics works trade.
3. Stakeholders in education, Non-governmental Organizations (NGOs), Parent Teachers` Association (PTA) and State Universal Basic Education Commission (SUBEC) should be encouraged and fascinated to provide sufficient funds so as to facilitate the tour on Simulink in MATLAB for delivery instructions in science and Technical subjects at Technical college level.

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