



## Effect of Virtual Learning on Students' Academic Achievement and Retention in Automotive Air Conditioning System in Colleges of Education in North Eastern Nigeria

<sup>1</sup>Bala Sai'du, <sup>2</sup>Daniel Kaleb Diraso, <sup>2</sup>Eric Borba Enoch

<sup>1</sup>Department of Vocational and Technology Education,  
Abubakar Tafawa Balewa University, Bauchi, Bauchi State

<sup>2</sup>Faculty of Education, Modibbo Adamawa University, Yola, Adamawa State

### ABSTRACT

The study examined the effect of virtual learning on students' academic achievement and retention in automotive air conditioning system in colleges of education in north eastern Nigeria. The rationale of the study was that virtual learning supports student-centred learning that encourages students- teacher interaction in an open face where there is no physical contact between the teacher and students. Three specific objective were formulated, there research questions raised and three null hypotheses were postulated A quasi-experimental design was adopted, involving NCE III Automobile Technology students from two Federal Colleges of Education (Technical) in North-East Nigeria. Simple random sampling was employed to select experimental and control groups. An instrument for data collection was Automotive Air Conditioning Achievement Test (AACAT). The instruments were, validated by experts and tested for reliability with reliability co efficient of .83. The experimental procedure involved administering pre-tests, implementing treatments (virtual learning for experimental group, lecture method for control), and post-tests. Data were analysed using descriptive and inferential statistics with SPSS, interpreting results based on predetermined criteria. Acceptance/rejection of hypotheses relied on the significance level ( $p < 0.05$ ).the study found that Automobile Technology Education Students taught Automotive Air Conditioning system using virtual learning and those taught using lecture method have different academic achievement after the treatment and there is significant difference in their mean academic achievement after the treatment. The recommendation advocate to offer supplementary support for virtual learning, providing additional resources, interactive simulations, or live online sessions specifically for virtual learners enhances understanding of concepts, bridging the gap in academic achievement and promoting equitable learning outcomes for all students.

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### INTRODUCTION

Technology has been designated as the basis for global development that many nations of the world have keyed into it. Essentially, technology is the primary engine of economic growth that plays fundamental role in wealth creation, improvement of the quality of life and real

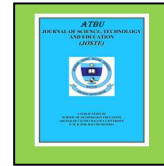
economic growth and transformation in any society (Abubakar, 2019). The impact of technology is felt in every aspect of human life so much that it is basically linked with all aspects of development in many parts of the world including the developing countries. Nigeria as a nation has seen the increasing importance of technological

Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi.

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development in all sectors of its economy that include the use of Information and Communication Technology (ICT) in education (Abubakar, 2021). This has been observed in recent time in most of the policies including ICT policy in education (Okonji & Okiki, 2018). Globally, the use of technology has paved way for effective instructional delivery in the educational systems including Technical and Vocational Education (TVE). In fact, technology in TVE offers numerous benefits on teachers' productivity (Iliya, 2017).

Technology has brought global transformation in digital media information in the instructional practices that progress in the 21<sup>st</sup> century. Most developed countries have taken advantage of the ICT age and improved their educational structure and developed their academic landscape for economic development (Fairlie & Robinson, 2019). Economic development of any nation depends largely on manner in which the structure of their education is linked to the global trends in the ICT. For instance, the field of Automobile is now fully ICT based from manufacturing process to repairing and maintenance stage. According to Allan (2015) computers and electronic devices are used to control the operation of an engine. Because of these controls, today's automobiles use less fuel, perform better, and run cleaner than those in the past. Computerized engine control systems control air and fuel delivery, ignition timing, emission systems operation, and a host of other related operations. The result is a clean-burning, fuel-efficiency and powerful engine (Erjavec & Thompson, 2014). This necessitates the embracing of ICT in Automobile manufacturing companies and the educational training institutions.

The Nigerian government acknowledged the importance of technology in teaching and learning process and came up with policies and programmes that harness the adoption of ICT at all levels of education. The improvement of infrastructure for virtual learning in recent times is a welcome development to the educational sector, as the country desired to meet up with the international community in term of educational development, through ICT utilization

in teaching and learning process (Agabi, Agbor, & Ololube, 2015).

Zheng, Naseer, Abbas and Sabir (2020), stated that, e-learning can come in various forms, such as Virtual Learning Environment (VLE) or Virtual Classroom Learning (VCL), Digital Collaboration (DC), Course-learning (CL), Web-based Learning (WBL) and Online Learning. These strategies complement traditional, face to face education and transform it into blended learning. Virtual learning refers to cognitive method of learning that combine various forms of multimedia to ease teaching and learning processes. Hence, virtual learning is essential to improve access to quality education and information as interaction between students and teachers is enhanced, opportunity for acquisition of up-to-date technological skills is at the front line.

Moreover, Borotis & Poulymenakou (2016) posited that virtual learning allows students to study at their open pace and convenience as the lecture material is readily available and the content delivery of the lecturer is quite accessible to them. Hence, it increases satisfaction and decreases stress in acquiring knowledge. The knowledge of virtual learning exposes both lecturers and students to the reality of the world outside the classroom since the world is a global web, it can be cost effective as it minimise travel time and infrastructural development. It is evident that beside the challenges in the implementation of virtual learning, it holds a substantial opportunity for Nigerian institutions to expand accessibility to virtual learning in higher education (Okoye & Arimonu, 2016; Adesope, Oke & Odekunle, 2018). This implied that the use of virtual instruction is of paramount importance in teaching Technical and Vocational Education (TVE) courses in colleges of education (Technical).

In order to reap the benefits of virtual learning, efforts should be made in the areas of automobile technology education lecturer development with regard to the use of modern technologies and innovations in teaching and learning process for student's achievement and retention to compete with their global counterpart. Researches have been conducted on the use of

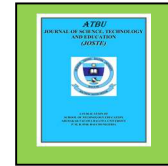
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Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

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modern technology for teaching in educational institutions (Yohanna, 2018; Novianti, Muhammad, Celine & Hario, 2019).

Colleges of Education are among the technical teacher training institutions in Nigeria. that leads to the award of Nigeria Certificate in Education (NCE), which aimed at providing technical teachers with intellectual and professional background adequate for teaching technical subjects and making them adaptable to changing situations in technological development. According to National Commission for Colleges of Education (NCCE) (2021), Automobile Technology is one of the courses offered in Nigerian Colleges of Education (Technical) to produce competent technical education teachers who can teach in the technical colleges and secondary schools. NCCE, further stated that automobile Graduates are expected to acquire teaching skills and appropriate method needed in imparting knowledge in their area of specialization, gain insight in maintenance of vehicles and work competently in automotive industries.

Automobile technology is one of the Technical and Vocational Education (TVE) programmes that involves the acquisition of scientific knowledge in design, selection of materials, construction, operation and maintenance of automotive (Adamu, LKama and Kumazhege, 2021). Similarly, Ilya (2017) defined automobile technology as a Technology Education programme run in Colleges of Education and other Institutions of higher learning that provides students with the opportunities of acquiring the capabilities and competencies that will make them practice as Automobile Technology Education graduates there by operating as specialist in the area.

Automotive air conditioning system is a component of automobile technology that deals with the process by which air is cooled, cleaned and dehumidified before entering or re-entering the passenger apartment (Stubblefield & Haynes, 2000). It is taught in the colleges of education at the NCE II and NCE III level as part of Heat Engines and Auto-Fueling and Air Conditioning courses respectively. Automobile technology

graduates of colleges of education are prepared for employment to serve as class teachers in primary and vocational training centers in order to transmit what they learn to younger ones. However, these graduates are not equipped with the skills needed to attain to the challenges in modern vehicle that are more of electronic and require skills in diagnosis (Adamu et al, 2021). Also Mohammed, (2019) stated that the failure of automobile graduate in colleges of education to reach up to expectation in skills and practical would be connected with the teaching strategies used by their lecturers. Teachers need to make learning interested in such a way that the required academic achievement and skill development will be adopted by the young learners rather than sticking to traditional chalk and talk (lecture) or demonstration methods.

Academic achievement is a learning outcome that determines the extent to which a student has realized their educational goal and can be measured by many form of assessment technique. Mustapha (2016) State that students' academic achievement is closely related and influenced by so many factors that include among others school environment, learner's interest, mental ability, availability of facilities and instructional strategies used by teachers. He also opined that instructional strategy in fact is the most influential of all the factors regarding students' achievement. The basis for achieving the goals of teaching and learning in technical and vocational education is to acquaint students with scientific skills, knowledge and enhances their interest in practical skills for self-reliance. Kumazhege (2016) state that Academic achievement can be moderated by some factors such as; teaching method, teacher qualification and personality, students' readiness, learning environment, facilities and equipment for the learning to take place.

Students are interested in learning when they are being taught by new strategy which will allow them to express themselves and make enquiries enthusiastically without hesitation. Shehu et al., (2016) stated that interest can be viewed as individual beliefs about the attributes of a particular object and may be influenced by

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Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi.

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various attributes towards a subject or learning environment. Adam (2022) also posited that interest on education is a very strong determinant not only of students' academic success but life in general. This therefore, indicates strongly that education should not only equip an individual with cognitive and psychomotor skills but also the inculcation in to the individual right type values. It is on this not that Kahu, Nelson and Picton (2017) stated that student interest and engagement with particular subjects, course or field of study will go throughout their school careers as the nature and relative importance of the influencing factors differs.

Considering the fact that today's teachers are working with students whose lives have been saturated with computer devices, prompted the researcher to determine the effect of virtual learning on students' academic achievement and interest in Automotive Air Conditioning System in Colleges of Education in North Eastern Nigeria.

#### STATEMENT OF THE PROBLEM

Despite the relevance of virtual learning in educational environment, the utilization of virtual platform especially at colleges of education is not impressive because most of the instructional delivery are still taking place in classroom using conventional method of instruction where both the students and lecturers have to be present in the classroom (Adesope, et al, 2018; Yohanna, 2018; Mohammed 2019; Adamu & Bala, 2021). This is in line with the argument of Dhawan (2020); Adamu & Bala, (2021); Abubakar, (2021) that the use of technology in teaching in Nigerian tertiary institutions is very minimal which is affecting the opportunity of Nigerian students to explore in various educational environment across the globe. Despite the efforts put by automobile technology lecturers in colleges of education to make learning interesting through the use of various teaching strategies such as lecture, demonstration and discussion method, reports show that there have been persistent failure of students of automobile in the colleges of education.(Adamu, L'Kama & Kumazhege, 2021; Abubakar, 2019; Mohammed, 2019).It was observed that the use of teaching

methods based on behaviourists theories emphasize knowledge transmission from the teacher to passive students and encouraged rote memorization of fact and make them not to retain it and apply it in new situations. Federal Colleges of Education (Technical), mostly use lecture and demonstration methods.

To the best of the researcher knowledge none of the existing studies determine the effect of virtual learning on students' academic achievement, interest and retention in Automotive Air Conditioning system in colleges of education in north-eastern Nigeria. Therefore, this study will address the existing gap and add more literature to the existing one.

#### Purpose of the Study

The main purpose of the study is to determine the effect of virtual learning on students' academic achievement and retention in automotive air conditioning system in colleges of education in north eastern Nigeria. Specifically, the study will seek to determine.

1. The pre-test achievement of Automobile Technology Education Students in Automotive Air Conditioning system in College of Education in North East Nigeria.
2. The post-test mean achievements scores of Automobile Technology Education Students taught Automotive Air Conditioning system using virtual learning teaching method in College of Education in north east Nigeria.
3. The retention level of Automobile Technology Education Students taught automotive air conditioning system using virtual learning and those taught using lecture method in Colleges of Education in North East Nigeria, using delayed post-test.

#### Research Questions

The following research question were raised to guide the study

1. What are the pre-test mean achievement scores of Automobile Technology Education Students in

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Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi.

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- Automotive Air Conditioning system in the experimental and control groups in College of Education in North East Nigeria?
2. What are the post-test mean achievements scores of Automobile Technology Education Students taught Automotive Air Conditioning system using virtual learning teaching strategy and those taught using lecture method in College of Education in North East Nigeria?
  3. What is the mean retention level of Automobile Technology Education Students taught automotive air conditioning system using virtual learning and those taught using lecture method in Colleges of Education in North East Nigeria, using delayed post-test?

### Hypotheses

The following hypotheses are formulated to guide the study and will be tested at 0.05 level of significant.

- Ho<sub>1</sub>** There is no significant difference between the pre-test mean achievement score of Automobile Technology Education Students of College of Education in virtual learning group and those in lecture method group in Automotive Air Conditioning system.
- Ho<sub>2</sub>** There is no significant difference between the pre-test and post-test mean achievements of Automobile Technology Education Students taught Automotive Air Conditioning system using virtual learning and those taught using lecture method in College of Education.
- Ho<sub>3</sub>** There is no significant difference between the retention level of Automobile Technology

Education Students taught automotive air conditioning system using virtual learning and those taught using lecture method in Colleges of Education in North East Nigeria, using delayed post-test.

### METHODOLOGY

A quasi-experimental design was adopted, involving NCE III Automobile Technology students from two Federal Colleges of Education (Technical) in North-East Nigeria. Simple random sampling was employed to select experimental and control groups. Data collection instruments included Automotive Air Conditioning Achievement Test (AACAT), thr instruments were validated by experts and tested for reliability at .83 reliability coefficient. The experimental procedure involved administering pre-tests, implementing treatments (virtual learning for experimental group, lecture method for control), administering of post-tests and a delayed post-test after two weeks to determine the retention ability of the students. Extraneous variables were controlled, and data were analysed using descriptive and inferential statistics with SPSS, interpreting results based on predetermined criteria. Acceptance/rejection of hypotheses relied on the significance level ( $p < 0.05$ )

### RESULTS

#### Research questions 1

What are the pre-test mean achievements scores of Automobile Technology Education Students in the experimental and control groups in College of Education in North East Nigeria?

**Table 1:** Pre-Test Mean Achievement Scores of Automobile Technology Education Students in the Experimental and Control Groups

	Teaching Method	N	Mean	SD	MD	Remark
pre-test	Virtual Learning	9	38.05	12.35	4.08	Fail
	Lecture Method	13	33.97	7.57		Fail

**Key:-** N- Number of Students, SD= Standard Deviation, MD= Mean Difference

Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

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The result of the pre-test mean achievement in Table 1 revealed that Automobile Technology Education students in experimental group had a mean score of 38.05 and standard deviation of 12.354 while these in control group had a mean score of 33.97 and standard deviation of 7.570. Considering their mean which fall within the same ranges indicated that they possess the same level of previous knowledge before the treatment, also considering their standard deviation which fall within the same range indicated that their responses to answers

across all question do not vary much. Therefore, their entry behaviour is the same.

**Research Questions 2:** What are the post-test mean achievements scores of Automobile Technology Education Students taught Automotive Air Conditioning system using virtual learning teaching strategy and those taught using lecture method in College of Education in North East Nigeria?

**Table 2:** Post -Test Mean difference in the Achievement Scores of Automobile Technology Education Students taught Using Virtual Learning and Those Taught using Lecture Method

	Teaching Method	N	Mean	SD	MD	Remark
post-test	Virtual	9	87.50	5.270	49.19	Pass
	Lecture	13	38.31	9.10		Fail

**Key:** -N- Number of Students, SD- Standard Deviation, Mean Difference

The result of the post-test mean achievement in table 2 revealed that the students in experimental group that is Automobile Technology Education Students taught Automotive Air Conditioning system using virtual learning have a mean of 87.50, with standard deviation of 5.270. While the students in control group that is Automobile Technology Education Students taught Automotive Air Conditioning system using lecture method have a mean of 38.31 and standard deviation of 9.107, considering their mean difference which was found to be 49.19, this is a wide merging and indicated that there was difference in their mean academic achievement after the treatment. Also considering their standard deviation which fall

within difference range indicated that their responses to answers across all questions varies. Thus, the findings indicated that virtual learning is effective teaching method better than conventional lecture method in teaching Colleges of Education Students Automotive Air Conditioning System.

**Research Question 3:** What is the retention level of Automobile Technology Education Students taught Automotive air Conditioning System using virtual learning and those taught using lecture method in Colleges of Education in north east Nigeria, using delayed post-test?

**Table 3:** Mean Retention level of Automobile Technology Education Students taught using Virtual Learning and those taught using Lecture Method

	Teaching Method	N	Mean	SD	Remark
Retention	Virtual	9	60.11	17.78	Pass
	Lecture	13	28.46	7.63	Fail

**Key:-N- Number of Students, SD- Standard Deviation, MD Mean Difference**

The result of the mean retention level in table 3 revealed that the students in experimental

group that is, Automobile Technology Education Students taught Automotive Air Conditioning

Corresponding author: Bala Saidu

[balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

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system using virtual learning had a mean score of 60.11, and standard deviation of 17.78. While the students in control group that is Automobile Technology Education Students taught Automotive Air Conditioning system using lecture method have a mean of 28.46 and standards deviation of 7.63, considering their standard deviation which fall within difference range indicated that their responses to answers across all questions varies. Thus, the findings show that virtual learning is an effective teaching method that enhances students' retention better than

conventional lecture method in teaching Automotive Air Conditioning System in Colleges of Education.

**Hypotheses 1**

**Ho<sub>1</sub>** There is no significant difference among the pre-test mean achievement score of Automobile Technology Education Students of College of Education in virtual learning group and those in lecture method group in Automotive Air Conditioning system

**Table 4:** Difference Among the pre-test mean achievement score of ATES of College of Education in virtual learning group and those in lecture method group in AAC system

	Teaching method	N	Mean	SD	Df	t	Sig	Remark
pre-test	Virtual	9	38.05	12.35	20	.96	.071	Accepted
	Lecture	13	33.97	7.57				

**Key:** N- Number of Students, SD-Standard Deviation, df- Degree of Freedom, Sig- Significant Value of t at  $p \leq$  or  $\geq 0.05$

Table 4 shows the t-test result of pre-test mean achievement of Students in experimental and control groups. The result indicated that, the experimental group had a mean score of 38.05 with a standard deviation of 12.35 while the control group had a mean score of 33.97 with a standard deviation of 07.57 within the degree of freedom 20,  $t = .963$ , p-value of .071, therefore, the p-value of .071 is greater than the confidence level ( $p > 0.05$ ). This indicated that there was no significant difference in the pre-test

mean achievement of the subject before the treatment. Therefore, the null hypothesis was retained.

**Hypothesis 2**

There is no significant difference between the post-test mean achievements of Automobile Technology Education Students taught Automotive Air Conditioning system using virtual learning and those taught using lecture method in College of Education.

**Table 5:** t-Test Result of Student's Achievement in Virtual Learning Group and in Lecture Method Group

	Teaching Method	N	Mean	S D	Df	t	Sig.	Remark
Post-test	Virtual	9	87.50	5.27	20	12.17	.00	Rejected
	Lecture	13	38.31	9.10				

**Key** N- Number of Students, SD-Standard Deviation, df- Degree of Freedom, Sig- Significant Value of t at  $p \leq$  or  $\geq 0.05$

Table 5 shows the t-test result of post-test mean achievement of Students in virtual learning and lecture method groups. The mean scores of the two groups in the achievement

scores are; virtual learning group (mean = 87.50, SD = 5.270) and lecture method group (mean = 38.31, SD = 9.107;  $t = 10.57$ ). The magnitude of the differences in the means is (mean difference = 49.19). The level of significance of 0.000 is less

Corresponding author: Bala Saidu

[balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi.

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than the p-value 0.05 significance level. This means that there is significant difference between the achievement scores of students taught Automotive Air Conditioning System using virtual learning and those taught the same concepts using lecture method at the post-test level of experimental and control group, since the significance value is less than the confidence level ( $\text{sig} < 0.05$ ). For that, the null hypothesis was rejected.

### Hypothesis 3

There is no significant difference in the mean retention level of students taught Automotive Air Conditioning system using virtual learning, and those taught using lecture method using delay post-test in Colleges of Education (Technical). The data that were used in testing this hypothesis were analysed using t-test and presented

**Table 6:** t-Test Result of Retention Mean Score of Automobile Technology Education Students of College of Education in Virtual Learning Group and those in Lecture Method Group

	Teaching Method	N	Mean	S D	Df	t	Sig.	Remark
Retention	Virtual	9	60.11	17.78				
	Lecture	13	28.46	7.63	10.06	5.027	.001	Rejected

**Key** N- Number of Students, SD-Standard Deviation, df- Degree of Freedom, Sig- Significant Value of t at  $p \leq$  or  $\geq 0.05$

Table 6 shows that the significant value of .001 is less than 0.05 significant levels. This means that there is significant difference in the delayed post-test (Retention) mean achievement of Automobile Technology Education Students of College of Education taught using virtual learning and those in lecture method of teaching in Automotive Air Conditioning system. Therefore the null hypothesis was rejected. Automobile Technology Education Students of College of Education taught using virtual learning has a mean of 60.11 and standard deviation of 17.787, while Automobile Technology Education Students of College of Education taught using lecture method has mean score of 28.46 and standard deviation of 7.633 with t value of 5.2077. The mean difference was found to be 31.65. Result indicated that virtual learning is more effective than the traditional lecture method of teaching in retaining the knowledge acquired after the treatment.

### FINDINGS OF THE STUDY

Based on the data analysis and the results obtained the following are the findings of the study

- 1) The finding revealed that Automobile Technology Education Students in the

experimental group and those in the control group possess the same level of previous knowledge before the treatment and there is no significant difference in their mean academic Achievement before the treatment. The corresponding hypothesis shows that there is no significant difference in the pre-test mean achievement of the subject before the treatment. Therefore, the null hypothesis was retained. Considering their mean which fall within the same ranges indicated that they possess the same level of entry behaviour.

- 2) Automobile Technology Education Students taught Automotive Air Conditioning system using virtual learning achieved more than those taught using lecture method after the treatment and the corresponding hypothesis shows that there is significant difference in their mean academic achievement after the treatment. Therefore, the null hypothesis was rejected. This shows that virtual learning is more effective than the lecture method of teaching in learning Automotive Air Conditioning

Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

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- System in Federal Colleges of Education (Technical).
- 3) The result of the mean retention score indicated that the Automobile Technology Education Students taught Automotive Air Conditioning system using virtual learning and those taught using lecture method differs in their retention level after the treatment. The corresponding hypothesis shows that there is significant difference in their mean academic achievement after the delayed post-test. For this the null hypothesis was rejected. This indicated that virtual learning is effective teaching methods that improve students' retention in Automotive Air Conditioning System in Federal Colleges of Education (Technical)

### DISCUSSION OF FINDINGS

The finding revealed that Automobile Technology Education Students in the experimental group and those in the control group possess the same level of knowledge before the treatment and there is no significant difference in their mean academic Achievement before the treatment. This equality confirms that the entire students in the two groups did not receive any treatment which equates all the groups on the same level. The relatively same achievement obtained from the two groups may be credited to the similar characteristics they possess interns of as ages, educational background and location. The study further revealed that the experimental group that is the virtual learning group; and the control group that is the lecture method group were almost homogeneous before the treatment was given to the groups. This could probably be due to the same type of instructional method, and same knowledge of the subject area covered, which the students have earlier been exposed to in their previous lessons.

The findings are in line with the findings of Eze, Jacinta and Oyonru (2020), as reported that students taught automobile technology had similar achievement at the pre-test level. In another study by Martin, Lotte, Stefanier, Elske

and Iris (2020), on students' predictor of online study also supported this finding. The findings are in line with the findings of Shehu, Abubakar, Mohammed and Saidu (2019), reported that there was no significant difference in achievement score of auto mechanic students in the experimental and control groups in the pre-test. Shehu et al findings was consistent with the findings of Tsyav (2016), who conducted a study on the multimedia technique on technical college students' academic achievement in auto-mechanics and reported that there was no significant difference in achievement score of auto mechanic students in the experimental and control groups in the pre-test.

The finding revealed that teaching using Virtual Learning yielded high achievement among the students of the experimental group. This in turn demonstrates the effectiveness of the approach over conventional lecture method. The finding conforms to the findings of Dhawan (2021) that virtual learning has been more frequently and widely used during the recent period and has played an irreplaceable role in the education industry, the influence of self-efficacy on virtual learning adoption should be paid more attention to in higher institutions. These could be viewed from the perception of Zheng *et al.*, (2020) as said virtual learning provides opportunities for people to learn in a more personalized, flexible, and portable manner without the restriction of time and space. It emphasizes change in the mode of delivery, such as a technology based learning in which learning materials are delivered electronically to remote learners.

Guidance by teachers or experts enables students to handle complex tasks such as reading, comprehension, writing and problem solving. This is in consonant with the findings of Cyril (2016b) who conducted a study on the effect multimedia instruction on students' performance and found out that there was a significant difference in the post-test score of students between the experimental and the control groups. However, The finding of the study carried out by Oyenuga (2016) on the effect of models on students' academic achievement and interest who found out that there was a significant difference between the mean achievement scores of

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Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi.

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students' in the experimental and the control groups. Based on this finding, it was established that students taught automotive air conditioning system using virtual learning instruction had better academic achievement than students taught using lecture method. This also agreed with findings of Nwanekezi and Kalu (2012), on their study that revealed students taught with multimedia instruction tended to be superior than those taught with lecture method.

The finding revealed that there were differences between retention level mean score achievement of students taught automotive air conditioning system using virtual learning strategies and those using lecture method. The test of hypothesis four shows that the difference between the groups was significant. The outcome of the study agreed with the earlier report of Adam (2021), that criticized the conventional teaching approach at colleges of education that is more of a teacher-centered that involved showing, telling and observing rather than ideal practice of learning by doing approach that involves both the teachers and the students, the authors stressed that the approach has negative effects on students' performance and interest on the use of automotive diagnostic tools. Similarly, Adamu and Jibrin (2017), reported that inappropriate instructional method has the tendency of creating nervousness and anxiety on students. These probably explained why Adunola (2011), reported that teachers need to be conversant with numerous teaching strategies that take recognition of the magnitude of complexity of students in their classes.

## CONCLUSION

The study examined the impact of virtual learning on academic achievement in automotive air conditioning systems among colleges of education in North Eastern Nigeria. It found that students taught through virtual learning and traditional lecture methods had similar levels of previous knowledge. However, significant differences in academic achievement were observed after the treatment, with virtual learning leading to notably different outcomes. These findings suggest that while both methods are

effective in imparting foundational understanding, virtual learning offers distinct advantages in enhancing academic achievement over time. Educators and policymakers should consider integrating virtual learning into the curriculum to optimize learning outcomes. Further research is needed to understand the specific mechanisms driving these differences and to develop effective strategies for implementing virtual learning initiatives

## RECOMMENDATIONS

The recommendations advocate for a multifaceted approach to instruction in automotive air conditioning systems:

- i. Automobile Technology Lecturers in Colleges of Education should be discouraged from the frequent use of the traditional teacher centred Method of teaching during instructional delivery; they should leverage virtual learning for improved academic achievement.
- ii. Preference should be given to Virtual Learning strategy than Lecture Method when teaching Automotive Air Conditioning System in Colleges of Education.
- iii. Preference should be given to Virtual Learning strategy than Lecture Method when teaching Automotive Air Conditioning System to enhance students' retention in Colleges of Education.

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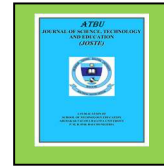
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Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi.

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Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi.

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Corresponding author: Bala Saidu

✉ [balasaidu58@gmail.com](mailto:balasaidu58@gmail.com)

Department of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi.

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