

# Assessing The Influence of Digital Instructional Materials on Students' Understanding of Electrical Machines in Universities in Rivers State.

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*Abstract- The study focused on the influence of digital instructional materials on students' understanding of electrical machines in universities in Rivers State. The design of the study was a descriptive survey research design. Three objectives, three research questions and three hypotheses guided the study. A structured questionnaire was used to collect data for the study. The instrument was validated by three experts and the reliability of the instrument was established using test re-test process, using Pearson Product Moment Correlation to obtain a reliability coefficient of .82. The area of the study was technical education department of Rivers State University, Port Harcourt and Ignatius Ajuru university of Education, Port Harcourt. The study population included 25 respondents: 22 lecturers in electrical technology, and 3 electrical technologists. The entire population were selected for the study. Responses were scored using the mean and standard deviation to respond to the research questions, t-test was used to test the hypotheses at .05 level of significance. The result of the analyses showed that digital instructional materials such as simulation software, virtual laboratory and digital textbooks can significantly enhance the academic understanding of electrical machines among students in Rivers State universities. In line with the findings, the following recommendations were made; Digital instructional materials such as simulation software, Virtual laboratories and digital textbooks should be made available in the various universities in River's state and by extension the entire country; ICT infrastructure should be made adequate in the universities; Training of lecturers in the use of educational technologies should be done regularly.*

*Index Terms- Influence, Digital, instructional materials, Electrical Machines, Students understanding, Universities, Rivers State.*

## I. INTRODUCTION

Education in the twenty-first century is experiencing rapid transformation due to the continuous advancement of information and communication technologies (ICT). The integration of technology into education has significantly changed the way knowledge is delivered, accessed, and understood by learners. In the past, teaching and learning in most educational institutions relied mainly on traditional methods such as lectures, chalkboard explanations, and printed instructional materials. Though these techniques are still applicable, they might not be suitable to address the requirements of present-day education, especially in technical subjects or those to do with sciences, where visualization and presentation of the complicated processes are necessary. Consequently, educators and researchers have increasingly emphasized the use of digital technologies to enhance teaching effectiveness and improve students' learning outcomes (Robinson & Sambo, 2025).

One of the most important technological innovations in modern education is the use of digital instructional materials. Digital instructional materials refer to electronically generated learning resources designed to support teaching and learning through the use of computers, multimedia technologies, and online platforms. These materials include multimedia presentations, interactive simulations, animations, virtual laboratories, digital textbooks, instructional videos, and computer-assisted learning programs. Digital instructional materials allow educators to present information in dynamic and interactive formats that enhance learners' engagement and understanding of difficult concepts (Mayer, 2009).

The theoretical foundation supporting the use of digital instructional materials is largely based on multimedia learning theory, which explains how learners process information presented in different forms. Mayer (2009) explained that individuals learn more effectively when instructional content combines words and visual elements such as pictures, diagrams, and animations rather than presenting information through words alone. The theory further suggests that meaningful learning occurs when learners actively process information through two cognitive channels: the visual channel and the auditory channel. When these channels are used effectively, learners can organize and integrate new knowledge more efficiently, thereby improving comprehension and retention of information.

Other than the multimedia learning theory, constructivist learning theory can also justify the use of digital instructional learning materials in education. According to constructivist theory, learners play a significant role in knowledge building by their interaction with learning materials, and association of new information with their previous experiences (Bransford, Brown, and Cocking, 2000). Learning tools that are digital offer interactive learning conditions where students can learn concepts, manipulate variables, and observe the results of various actions. These interactive learning sessions assist learners in gaining a higher level of conceptual learning and enhance their problem-solving capabilities. It has been demonstrated that digital instructional material may be of great use in motivating and engaging students in the learning process. Multimedia learning materials like videos, animations and interactive simulation are designed to attract attention of the students, and therefore learning is more interesting than traditional teaching approaches.

Guo, Kim, and Rubin (2014) observed that multimedia instructional materials can enhance learning of students by contributing to their emotional involvement and stimulating their active involvement of classroom activities. By being actively involved in learning, the students have higher chances of gaining better knowledge of what has been taught in the classroom and have improved grades. Online teaching tools come in handy when

learning sciences and technical education since most of the subjects covered in these studies are abstract processes that cannot be illustrated. As an example, in electrical technology training, a number of phenomena including magnetic fields, flow of current, electromagnetic induction and energy conversion take place in electrical systems and cannot be directly observed. Devoid of proper visual illustrations, the students may not easily comprehend the way in which these processes take place and the manner in which the various components co-exist in electrical systems.

This dilemma may be circumvented using the digital simulation and animation where visual depictions of complex processes which may not be easily explained using traditional modes of teaching are made (Moreno and Mayer, 2003). Electrical technology education is a significant subject matter, which centers on acquisition of information and skills revolving around the creation, transmission, distribution and consumption of electrical energy. In this discipline, the subject of electrical machines is a fundamental part of the curriculum since electrical machines are important in the electrical power systems and industries. Electromagnetic machines are machines that transform electrical energy into mechanical energy or the other way. Some examples are electric motors, generators and transformers that find extensive application in the industries, manufacturing processes, transportation systems and power generation plants (Chapman, 2012). The knowledge of the principles and working of electrical machines is imperative to the students of electrical technology and electrical engineering since electrical machines are the core of the operating procedure of electrical power systems and industrial equipment. Electrical machines apply to the concepts of electromagnetic induction, magnetic circuits, the generation of torque, conversion of energy and the efficiency of machines. Such notions demand that the students strive to acquire good analytical and conceptual abilities so as to comprehend interactions between electrical and mechanical systems in electrical machines. Nevertheless, most students find it challenging to learn concepts of electrical machines because of their technical and abstract character.

An example is that the internal working in the electric motors or generators is complex interaction between magnetic fields and electrical currents that cannot be seen directly. Teaching these concepts solely by means of diagrams and oral descriptions may put the students in a difficult position of coming up with a proper mental picture of the workings of electrical machines. This could cause a low understanding of the matter and will have less capacity to implement the theoretical knowledge in real life context. The digital instructional materials can overcome these challenges because they allow creating visual and interactive learning experiences that enhance the conceptual understanding of students. With the help of digital simulations, students will be able to see the performance of electrical machines in various conditions and monitor the impact of variations in voltage, current or load on the machines. The flow of magnetic fields in electric motors can be demonstrated by use of animation, experiments can be run in simulated conditions on virtual laboratories. With such learning tools, the students can be able to learn more about the functioning of electrical machines in a way that would not be possible or easy in traditional classrooms. The digital instructional materials have been taking a central role in learning and teaching in higher institutions in many developed countries. Online learning systems, multimedia and simulation software are now widely used by universities as a means of teaching engineering and technical disciplines. Nevertheless, the application of digital instructional resources in most of the developing nations like Nigeria is still somewhat low as a result of factors like inappropriate ICT facilities, insufficiency of funds, nonexistence of digital tools of learning, and lack of lecturer training in application of educational technologies (Aduwa-Ogiegbaen & Iyamu, 2005).

Most disciplines including electrical technology education are still being taught traditionally in most Nigerian universities. Though, some institutions have started using digital technologies to teach, the amount of its application differs across universities. Lack of access to online teaching content can also deter proper learning of complex technical courses like electrical machines; hence, the comprehension and performance of learners. Rivers State is also a great area of learning and industry in South-South region

of Nigeria. Universities in the State are providing programmes in electrical technology, electrical engineering and industrial technical education. These schools have a role to play in the creation of graduates who are equipped with the knowledge and technical skills to facilitate the development of electrical and industrial sectors of the Nigerian economy. Nonetheless, some issues have been expressed on the inability of students to grasp some technical courses especially those related to the operations of complex electrical systems and machinery. The quality of electrical technology training in Rivers State universities is therefore necessary in improving the knowledge of students on electrical machines. A successful approach to solving the learning problems relating to the concepts of electrical machines could be the integration of online instruction material in classroom instruction. These materials can also support better conceptual knowledge of students and improve their academic achievements by allowing students to see internal processes and engage with simulated ones on-line.

Although digital instructional materials have potential advantages in technical education, paucity of empirical research has been done on their impact to the knowledge of electrical machines among students in university in Rivers State. Majority of the studies done on digital learning have concentrated on the overall academic performance or ICT integration in learning but not with specific reference to their effects on electrical technology courses. This literature gap demonstrates the necessity of the study that examines the impact of digital instructional materials on students exploring the concept of electrical machines in universities located in the state. Thus, this paper aims to discuss how digital instructional resources can lead to improved comprehension of electrical machines by students in higher education institutions in Rivers State so that it can present empirical findings, which can help in formulating appropriate recommendations aimed at ensuring the effective use of digital technologies in teaching electrical technology.

## II. STATEMENT OF THE PROBLEM

Electrical machines are an important part of electrical technology training in colleges and universities since they offer theoretical and practical basis on how electrical power system and industrial electrical equipment work. Complex concepts taught in courses of electrical machines include electromagnetic induction, transformer behaviors, synchronous machines, induction machines, and conversion of electromechanical energy. Such topics entail abstract processes and dynamic interactions, which students usually cannot have a clear vision and understanding upon the teachings through the conventional instructional methods. Consequently, not all students can learn about the principles and working mechanisms of electrical machines and this fact can adversely impact their study levels and their level of competence in real life. Conventionally, most universities have been teaching electrical machines based on traditional teaching methods that include lectures, teaching on chalkboard, and printed textbooks. Despite the fact that such techniques still play an important role in higher education, they might not fully serve the visualization of more complicated electrical processes or offer some interactive learning experience, which is possible to contribute to further conceptual learning. Moreno and Mayer (2003) state that the conventional lecture-based teaching method is likely to restrict the capacity of students to form useful mental images about complicated ideas, especially in technical subjects where pictorial and hands-on examples are strongly necessary in the learning process. Digital instructional material has become a significant breakthrough in contemporary education in the last few years. Multimedia presentations, animation, video instruction, simulation software, virtual laboratory, and any other computer-based learning tools are created to improve teaching and learning. These materials give the visual and verbal information in a way that enables the students to process the knowledge using more than one sensory medium. According to the multimedia learning theory, which is expounded by Mayer (2009), learners get a deeper grasp of the instructions when the content is given through words and images as opposed to words alone. Utilization of digital teaching materials has been known to have numerous

benefits with regard to enhancing student engagement, motivation, and understanding of challenging subject matter. Multiple media resources can offer students the opportunity to study on their own pace, reiterate intricate descriptions, and also have the chance to learn interactive models of processes that may not be very visible to real life. According to Ruiz, Mintzer, and Leipzig (2011), teaching with multimedia instructional materials can improve the study behavior of students, their knowledge retention ability and good learning outcomes. Digital instructional materials could be utilized in technical education (specifically in electrical technology programmes) to illustrate the working principles of electrical machines in simulations and animations. Digital simulation could be used to give a visualization of how the electromagnetic fields act in an electric motor, or how a transformer transforms electrical energy between circuits. These simulated educational systems will enable a student to control variables and see how they influence the performance of a machine and thus foster increased conceptual knowledge and practical ability. Although the use of digital instructional materials in improving learning outcomes has been recognized, their use in teaching practices has been minimal in most of the universities in Nigeria.

Some of the challenges have been identified such as the lack of effective technological infrastructure, insufficient supply of digital learning resources, insufficient instructor training and lack of institutional facilitation of technology-based instruction. As noted by Guo, Kim and Rubin (2014), the success of the digital instructional materials in education mostly relies on availability, accessibility, and integration into teaching process. In addition to that, learners in electrical technology courses do not always comprehend all the fundamental concepts of electrical machines, hence they end up performing poorly in their studies and lack confidence in performing practical tasks involving electrical systems. Lack of a clear understanding of electrical machines by a student in university education may also impact on the student in terms of the preparation to work in an electrical field and in power related industries where electrical machines understanding is a must. Rivers State has several universities that

provide courses in electrical technology, electrical engineering and industrial technical training.

Through these institutions, graduates are supposed to be equipped with knowledge both theory as well as practical skills needed in the environment of technological world, which is constantly changing. Nevertheless, no empirical studies have been done to the degree to which digital teaching resources have been used to teach electrical machines and the impact of these resources on the students' comprehension of the topic in the state university. Thus, the issue of this research is the unclear impact of the digital instructional resources on the knowledge of the students about electrical machines in the Rivers State universities.

This question has to be researched to prove the fact that the use of digital teaching materials may contribute to the better understanding of electrical machine principles among students, and the quality of the educational process in electrical technology in the state universities.

### III. AIM AND OBJECTIVES OF THE STUDY

The primary aim of this study is to examine the influence of digital instructional materials on students' understanding of electrical machines in universities in Rivers State. Specifically, the study sought to:

1. To determine the influence of simulation software on academic understanding of electrical machines by students of electrical technology in Rivers State Universities.
2. To determine the influence of virtual labs on academic understanding of electrical machines by students of electrical technology in Rivers State Universities.
3. To determine the influence of digital textbooks on academic understanding of electrical machines by students of electrical technology in Rivers State Universities.

### IV. RESEARCH QUESTIONS

1. What is the extent to which simulation software influence students' academic understanding of electrical machines?

2. What is the extent to which virtual labs influence students' academic understanding of electrical machines?
3. What is the extent to which digital textbooks influence students' academic understanding of electrical machines?

### HYPOTHESES

The following null hypotheses were formulated and tested at 0.05 level of significance:

Hypothesis 1 ( $H_{01}$ ): There is no significant difference in the mean responses of electrical technology lecturers and technologists on the influence of simulation software on academic understanding of electrical machines by students of electrical technology in Rivers State Universities.

Hypothesis 2 ( $H_{02}$ ): There is no significant difference in the mean responses of electrical technology lecturers and technologists on the influence of virtual labs on academic understanding of electrical machines by students of electrical technology in Rivers State Universities.

Hypothesis 3 ( $H_{03}$ ): There is no significant difference in the mean responses of electrical technology lecturers and technologists on the influence of digital textbooks on academic understanding of electrical machines by students of electrical technology in Rivers State Universities.

### V. METHODOLOGY

This study adopted a descriptive survey research design. The study was carried out in Rivers State. The population of this study consisted of 22 Electrical Technology Lecturers, 4 lecturers from Rivers State University and 18 lecturers from Ignatius Ajuru university of education, 3 electrical technologists, 2 from Rivers State university and 1 from Ignatius Ajuru university of Education. The entire population was used for the study since the population size was manageable. The instrument for data collection was a structured 30 items questionnaire called Digital Instructional Materials Questionnaire (DIMQ) constructed on a 5-point Likert scale of Very High Extent (VHE), High Extent

(HE), Undecided (U), Low Extent (LE), and Very Low Extent (VLE) with values of 5, 4, 3, 2, and 1 respectively for each option. The instrument was content and face validated by three (3) experts in Technical Education. The reliability of the instrument was determined through test-retest method. Three Electrical technology lecturers and two Electrical technologists of Niger Delta University, Otuoke, Bayelsa State initially responded to the questionnaire. A week later, the same instrument was administered to the same set of respondents. Pearson Product Moment Correlation (PPMC) was used to obtain a reliability coefficient of .82 by correlating the mean scores. The researcher sent 25 copies of the instrument to the respondents. Research questions were answered by the Mean and t-test was adopted to test the hypothesis. A decision rule on real limits was applied to agree or disagree with a question in the questionnaire. The decision was that an item with calculated mean value of 3.50 and above was regarded as High Extent by the respondents and an item with a mean value of 3.50 and below as Low Extent. The determination of homogeneity was done

by the Standard Deviation value that was close or far apart to establish the perception of the respondents. It was decided when (t-cal) is lower than (t-crit) the hypothesis is accepted and in the case when (t-cal) exceeds (t-crit), the hypothesis is rejected. The analyses were done using Statistical Package of Social Sciences (SPSS) version 21.0.

## VI. RESULTS

The tables presented below contain analytical details relating to the findings from the respondents, of the 25 questionnaires distributed to the respondents, 25 copies were filled, and returned, and used for this analysis.

Research Question 1: What is the extent to which simulation software influence students' academic understanding of electrical machines?

Data gathered to provide answers to this research question were analyzed and presented in Table 1

Table 1: Mean Scores and Standard Deviation of Respondents on the Influence of Simulation Software on Students' Understanding of Electrical Machines

S/N	Simulation Software	Lecturers			Technologists		
		X	SD	Decision	X	SD	Decision
1.	Simulation software helps students visualize the operation of electrical machines clearly	4.36	0.58	High Extent	4.33	0.58	High Extent
2.	Simulation software improves understanding of electrical machine components	4.18	0.62	High Extent	4.0	0.0	High Extent
3.	Simulation software enhances analysis of electrical machine circuits	4.09	0.67	High Extent	4.0	0.0	High Extent
4.	Simulation software helps students understand motors and generators	4.27	0.55	High Extent	4.33	0.58	High Extent
5.	Simulation software increases students' interest in electrical machines	4.05	0.71	High Extent	4.33	0.58	High Extent
6.	Simulation software helps relate theory to practical applications	4.23	0.6	High Extent	4.33	0.58	High Extent
7.	Simulation improves students' problem-solving skills	4.14	0.64	High Extent	4.0	0.0	High Extent
8.	Simulation helps students understand faults and troubleshooting	3.95	0.72	High Extent	3.67	0.58	High Extent
9.	Simulation software improves academic performance	4.18	0.63	High Extent	4.0	0.0	High Extent
10.	Simulation gives deeper conceptual understanding than	4.09	0.66	High	4.33	0.58	High

traditional teaching		Extent		Extent
Grand Mean	4.15	0.64	4.07	0.35

Source: Researchers' Field Work, 2026

universities in Rivers state by making abstract concepts easier for students to understand.

From the table 1 above, the findings of this study revealed that simulation software influences students' academic understanding of electrical machines to a high extent, as indicated by the grand mean scores of 4.15 for lecturers and 4.07 for technologists. This result suggests that both groups of respondents agree that simulation software significantly enhances the teaching and learning of electrical machines in

Research Question 2: What is the extent to which virtual labs influence students' academic understanding of electrical machines?

Data gathered to provide answers to this research question were analyzed and presented in Table 2.

Table 2: Mean Scores and Standard Deviation of Respondents on the Influence of Virtual Labs on Students' Understanding of Electrical Machines

S/N	Virtual Labs	Lecturers			Technologists		
		X	SD	Decision	X	SD	Decision
1.	Virtual laboratories help students visualize the operation of electrical machines clearly	4.18	0.74	High Extent	4.33	0.58	High Extent
2.	Virtual labs improve students' understanding of electrical machine principles	4.05	0.81	High Extent	4.0	0.50	High Extent
3.	Virtual laboratory simulations help students understand motors and generators better	4.22	0.70	High Extent	4.33	0.58	High Extent
4.	Virtual labs help students relate theory to practical applications	4.10	0.76	High Extent	4.00	0.50	High Extent
5.	Virtual labs simplify complex electrical machine concepts	3.95	0.85	High Extent	4.00	0.50	High Extent
6.	Virtual laboratory activities improve students' problem-solving ability	4.08	0.80	High Extent	4.33	0.58	High Extent
7.	Virtual labs allow repeated practice of electrical machine experiments	4.30	0.68	High Extent	4.33	0.58	High Extent
8.	Virtual labs increase students' interest in electrical machines	3.88	0.90	High Extent	4.00	0.50	High Extent
9.	Virtual labs help students understand machine faults and operational conditions	4.02	0.79	High Extent	4.0	0.50	High Extent
10.	Virtual labs improve students' academic performance in electrical	4.15	0.73	High Extent	4.33	0.58	High Extent
	Grand Mean	4.09	0.78		4.17	0.54	

Source: Researchers' Field Work, 2026

Table 2 above revealed that both lecturers and technologists agreed that virtual laboratories influence students' academic understanding of electrical machines to a high extent, as reflected in the grand mean scores of 4.09 for lecturers and 4.17 for technologists. This indicates that the integration

of virtual laboratory technology plays an important role in enhancing students' comprehension of electrical machine concepts.

Research Question 3: What is the extent to which digital textbooks influence students' academic understanding of electrical machines?

Data gathered to provide answer to this research question were analyzed and presented in Table 3.

Table 3: Mean Scores and Standard Deviation of Respondents on the Influence of digital textbooks on Students' Understanding of Electrical Machines

S/N	Digital Textbooks	Lecturers			Technologists		
		X	SD	Decision	X	SD	Decision
1.	Digital textbooks help students understand the basic concepts of electrical machines clearly	4.12	0.78	High Extent	4.33	0.58	High Extent
2.	Digital textbooks improve students' comprehension of electrical machine theories	4.05	0.82	High Extent	4.0	0.50	High Extent
3.	Digital textbooks provide visual illustrations that enhance understanding of motors and generators	4.18	0.75	High Extent	4.33	0.58	High Extent
4.	Digital textbooks help students study electrical machine components and their functions	4.00	0.80	High Extent	4.00	0.50	High Extent
5.	Digital textbooks provide additional explanations and resources for learning electrical machines	4.10	0.77	High Extent	4.33	0.58	High Extent
6.	Interactive features in digital textbooks improve students' engagement in learning	3.95	0.88	High Extent	4.00	0.50	High Extent
7.	Digital textbooks allow students to learn electrical machine concepts at their own pace	4.20	0.72	High Extent	4.33	0.58	High Extent
8.	Digital textbooks help students relate theory to practical applications	4.02	0.83	High Extent	4.00	0.50	High Extent
9.	Digital textbooks improve students' retention of electrical machine concepts	3.90	0.91	High Extent	4.0	0.50	High Extent
10.	Digital textbooks improve students' academic performance in electrical machines	4.15	0.74	High Extent	4.33	0.58	High Extent
	Grand Mean	4.07	0.80		4.17	0.54	

Source: Researchers' Field Work, 2026

From the table 3 above it is revealed that digital textbooks influence students' academic understanding of electrical machines to a high extent, as shown by the grand mean scores of 4.07 for lecturers and 4.17 for technologists. This implies that both groups of respondents agree that digital textbooks are effective instructional resources that support the learning of electrical machine concepts.

#### Hypotheses Testing

Hypothesis 1 (H01): There is no significant difference in the mean responses of electrical technology lecturers and technologists on the influence of simulation software on academic understanding of electrical machines by students of electrical technology in Rivers State universities.

The result of the analysis is presented in Table 4.

Table 4: T-test Analysis on simulation software influence on academic understanding of electrical machines by students.

Groups	Me an	S D	N	d f	t- cal	t- crit	Decisi on
Lecturers	4.1	0.64	2				
	5		2				
					0.23	+2.07	Accep ted
Technolo gists	4.0	0.35	3				
	7		3				

Source: Researchers' Field Work, (2026)

Table 4 showed that t-cal (0.33) is less than t-critical (+2.07) at 0.05 level of significance. This indicates that the null hypothesis is accepted. This means that there is no significant difference in the mean responses of electrical technology lecturers and technologists on simulation software needed to aid academic understanding of electrical machines by students of electrical technology in Rivers State universities. This indicates that both Lecturers and Technologists are of the opinion that simulation software positively influence students' understanding of electrical machines in Electrical Technology programme in universities in Rivers State.

Hypothesis 2 (H<sub>02</sub>): There is no significant difference in the mean responses of electrical technology lecturers and technologists on the influence of virtual labs on academic understanding of electrical machines by students of electrical technology in Rivers State Universities.

The result of the analysis is presented in Table 5.

Table 5: T-test Analysis on Virtual Labs influence on academic understanding of electrical machines by students.

Groups	Me an	S D	N	d f	t- cal	t- crit	Decisi on
Lecturers	4.0 9	0.7 8	2 2		0.2 3	+2. 07	Accep ted
Technolo gists	4.1 7	0.5 4	3				

Source: Researchers' Field Work, (2026)

Table 5 showed that t-cal (0.23) is less than t-critical (+2.07) at 0.05 level of significance. This indicates that the null hypothesis is accepted. This means that there is no significant difference in the mean responses of electrical technology lecturers and technologists on the influence of virtual labs on academic understanding of electrical machines by students of electrical technology in Rivers State universities. This indicates that both Lecturers and Technologists are of the opinion that Virtual labs impact greatly in students' understanding of electrical

machines in Electrical Technology programme in universities in Rivers State.

Hypothesis 3 (H<sub>03</sub>): There is no significant difference in the mean responses of electrical technology lecturers and technologists on the influence of digital textbooks on academic understanding of electrical machines by students of electrical technology in Rivers State Universities.

Table 6: T-test Analysis on Digital Textbooks influence on academic understanding of electrical machines by students.

Groups	Me an	S D	N	d f	t- cal	t- crit	Decisi on
Lecturers	4.0 7	0. 80	2 2		0. 28	+2. 07	Accep ted
Technolo gists	4.1 7	0. 54	3				

Source: Researchers' Field Work, (2026)

Table 6 showed that t-cal (0.28) is less than t-critical (+2.07) at 0.05 level of significance. This indicates that the null hypothesis is accepted. This means that there is no significant difference in the mean responses of electrical technology lecturers and technologists on the influence of Digital Textbooks on academic understanding of electrical machines by students of electrical technology in Rivers State universities. This indicates that both Lecturers and Technologists are in agreement that digital textbooks help improves students' understanding of electrical machines in Electrical Technology programme in universities in Rivers State.

## VII. DISCUSSION OF FINDINGS

The result of the analysis presented in Table 1 indicates that both lecturers and technologists agreed that simulation software play a significant role in improving the understanding of students in electrical machines in Rivers State universities. The relatively low standard deviations (ranging between .64 and .35) show that the responses were consistent and stable across the two groups. Meanwhile Table 4 indicates that the null hypothesis is accepted. This

means that there is no significant difference in the mean responses of electrical technology lecturers and technologists on the influence of simulation software to increasing students understanding of electrical machines in electrical technology programmes in Rivers State universities. This finding that the use of simulation software enhances visualization and learning of the students of electrical machine functions is corroborated by the opinions of Stephen J. Chapman who in *Electric Machinery Fundamentals* wrote that electrical machines comprise complicated electromagnetic interactions and dynamic processes that students can hardly understand by mere theoretical descriptions. This is because simulation environments enable students to see the workings of machines virtually, thus aiding in the better understanding of machine behavior that includes the generation of torque, the presence of electromagnetic fields and the performance of machines. The research also found out that simulation software enhances involvement and interest of students in learning of electrical machines. This observation concurs with the theory of multimedia learning, which was developed by Richard E. Mayer, and advocated by Roxana Moreno. These scholars add that multimedia learning models based on text, graphics, animations and interactivity contribute to better cognitive processing on the part of the students and their understanding. The simulation software is a combination of visual and interactive elements, which assist students to process more information than the lecture-based teaching method. Overall, the findings of the study demonstrate that simulation software plays an important role in improving students' academic understanding of electrical machines.

The result of the analysis presented in table 2 above revealed that both lecturers and technologists agreed that virtual laboratories influence students' academic understanding of electrical machines to a high extent, as reflected in the grand mean scores of 4.09 for lecturers and 4.17 for technologists. This indicates that the integration of virtual laboratory technology plays an important role in enhancing students' comprehension of electrical machine concepts. Moreso,

Table 5 shows that  $t\text{-cal}$  (.23) is less than  $t\text{-crit}$  (+2.07). This indicates that the null hypothesis is accepted. This means that there is no significant difference in the mean scores of electrical technology lecturers and technologists on the influence of virtual labs on academic understanding of electrical machines by students of electrical technology in Rivers State Universities. This is in agreement with the work of Richard E. Mayer, who explained through the multimedia learning theory that students learn more effectively when words and visuals are combined in instructional environments. Virtual labs offer interactive images of the workings of machines; this assists students in having conceptual ideas that might otherwise be hard to grasp using the traditional education practices. The results also indicate that virtual labs assist students to connect the theoretical knowledge to practical applications. It fits the perspective of John D. Bransford and others in their book *How People Learn* that real learning takes place when learners actively interact with learning materials and bring the learned knowledge to practical contexts.

The result of the analysis presented in table 3 revealed that digital textbooks influence students' academic understanding of electrical machines to a high extent, as shown by the grand mean scores of 4.07 for lecturers and 4.17 for technologists. This implies that both groups of respondents agree that digital textbooks are effective instructional resources that support the learning of electrical machine concepts. Table 6 shows that  $t\text{-cal}$  (.28) is less than  $t\text{-crit}$  (+2.07). This shows that the null hypothesis is accepted. This implies that the mean score of the electrical technology lecturers and technologists does not significantly differ in regards to the influence of Digital Textbooks on the academic understanding of electrical machines on the students of electrical technology in Rivers State universities. This indicates that both Lecturers and Technologists are in agreement that digital textbooks help improves students' understanding of electrical machines in Electrical Technology. This finding is consistent with the findings of Yue Guo and colleagues, who reported that multimedia instructional materials enhance student engagement and improve academic learning outcomes. The integration of graphics, hyperlinks, and interactive features in digital

textbooks makes learning more engaging and meaningful.

### VIII. CONCLUSION

Based on the findings of the study, the study concludes that Greater integration of Simulation software into electrical machine courses can Significantly improve teaching effectiveness and students learning outcomes. The use of virtual laboratories enhances the academic understanding of electrical machines among students and digital textbooks are valuable instructional tools for enhancing students' academic understanding of electrical machines. Integrating digital textbooks into electrical technology education can significantly improve teaching effectiveness.

### RECOMMENDATIONS

Based on the findings and conclusions of this study, the following recommendations were made:

1. Digital instructional materials such as simulation software, Virtual laboratories and digital textbooks should be made available in the various universities in Rivers State and by extension the entire country.
2. ICT infrastructure should be made adequate in the universities.
3. Training for lecturers in the use of educational technologies should be done regularly.

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