

## **FACTORS MILITATING AGAINST THE UTILIZATION OF INTERNET OF THINGS IN CLASSROOMS IN TERTIARY INSTITUTIONS IN RIVERS STATE**

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### **ABSTRACT**

*The Internet of Things (IoT) is a relatively emerging technology that facilitates interaction between real and virtual objects in teaching and learning. Its implementation in the classrooms of some tertiary institutions is faced with challenges. Thus, this research investigates the factors militating against internet of things utilization in classrooms in tertiary institutions. Specifically, the study considered lack of ICT facilities, network connectivity, and knowledge of ICT as factors militating against internet of things utilization in classrooms in tertiary institutions in Rivers State. The study adopted a descriptive survey design with a sample size of 400 selected via random sampling. The study was guided by three research questions and three null hypotheses, which were tested at the 0.05  $\alpha$ -level of significance. A structured questionnaire consisting of 15 items with a reliability coefficient of 0.86 computed using Cronbach alpha was used for data collection. The research questions were answered using the mean and standard deviation, while the hypotheses were tested with linear regression statistics. The findings revealed that the use of the internet of things in classrooms in tertiary institutions in Rivers State is influenced by the lack of ICT facilities, network connectivity, and knowledge of ICT. The incorporation of the internet of things in the classroom of tertiary institutions will enhance participation and concretize complex learning. Therefore, it was considered essential for the government to provide the technological devices and organize programs that can boost teachers' and students' internet of things compliance in the classrooms.*

***Keywords: Classroom, network connectivity, ICT, Internet of things, Tertiary Institutions,***

### **INTRODUCTION**

Advances in information and communications technology (ICT) have profoundly altered how people communicate over the last two decades. In recent years, significant developments have been made in electronic devices, communication media, infrastructure, transmitter and receiver mechanisms, and protocols. Continuous advancements in information technology have provided opportunities for higher education institutions to advance their teaching and research, as these institutions consciously rely on timely information to become proactive (Agostini & Nosella, 2020). The emergence of technology has had a significant impact on the teaching and learning process and strategies, as well as the roles of trainers and teachers. The combination of technology-based learning and the internet lowered the effort and time required to access knowledge resources (Sarkar, 2012; Kebritchi et al., 2017). Technology has improved the ability to communicate and collaborate. Collaboration among learners and working groups has gotten simpler, particularly for teachers and students. Virtual tools and labs, visual and audio apps, and electronic games are just a few examples of how technology may assist students and teachers in improving the teaching and learning environment (Wai et al., 2018; Xiangming & Songs, 2018).

The Internet of Things is an amalgamation of devices, software, sensors, and networks working together to extract important and usable data or information generated from it (Kumar et al., 2019). The Internet of Things benefits businesses in a variety of ways, from increasing corporate efficiency to consumer happiness. However, the most significant IoT benefits for any firm are communication, control and automation, and cost reduction (De Vass et al., 2021). It often generates a high-capacity ecosystem with an open architecture for both virtual and physical items. This capability enables the development of a wide range of applications (Xiangming & Songs, 2018). As previously said, one of

the most prevalent applications of the Internet of Things is in education, notably online schooling. From a creative standpoint, online education is the most tangible success, providing a powerful, scalable platform for e-learning that allows educators and students to collaborate in real time, depending on the subject of education. This collaboration has the potential to significantly improve learning performance, efficiency, and online assessment speed.

The Internet of Things facilitates communication between people and systems, lowering the cost of employee and equipment downtime (Fleisch, 2010). By gaining access to real-time data, the IoT can help a manufacturing organization cut equipment maintenance costs and enhance production output. It can also be used by transportation and forwarding businesses to minimize maintenance costs and improve delivery service. When data from various devices and sensors is collected, stored in a single location, and statistically analysed, new real-time insights and services are provided. When IoT is combined with other technologies such as fog computing, edge computing, cloud computing, big data, data mining, and machine learning, this can be accomplished (Lee et al., 2022). The Internet of Things currently consists of improved sensor technology, sufficient processing power, and preferred wireless networks, all of which facilitate the rollout of IoT applications across a wide range of business functions, including production, telecommunications, agriculture, power and energy, healthcare, logistics, supply chain, security, and defence. Interconnected security systems, regulators, electronic machines, electric lights in homes and commercial spaces, alarm clocks, speaker systems, vending machines, and other IoT applications are the most common (Daz-Díaz et al., 2017; Kumar et al., 2019). Fog computing and edge computing aid in real-time data communication generated by the IoT via various communication channels and logs. This assists managers in making real-time decisions in their businesses. Cloud computing provides a global infrastructure for storing this real-time data, and data analysis is performed with big data technologies like Hadoop, NoSQL, and cloud-based Database as a Service (DaaS) (Pang et al., 2015; Tadejko, 2015). Data mining and machine learning, sometimes known as artificial intelligence, are techniques used to discover new patterns in data. This data can be used by application developers to create new business applications (Díaz-Díaz et al., 2017).

The Internet of Things has boosted learning and teaching in education by adding value to structures and educational environments. Furthermore, when it comes to employing IoT devices to make education more collaborative, participatory, and accessible to all, the education sector is one of the most adaptive and effective industries (Pang et al., 2015; Sezer et al., 2017). Students can access their assignments and test results via cell phones and PDAs via internet portals using IoT devices, video files can be saved to the cloud, and students can participate in classroom lectures remotely using online video conferencing (Demirkan et al., 2015; Klaib et al., 2021). IoT devices are used to track students who skip classes, give reminders to help students focus on their academic work, and retrieve misplaced personal goods (Faritha-Banu et al., 2020). Teachers may now assess student learning progress in real time thanks to the Internet of Things. Time, as well as solutions for smart and sustainable campuses to improve student learning techniques and the effectiveness of day-to-day operations in the institution.

The Internet of Things facilitates a shift in teaching methods from traditional to digital, resulting in a number of extra benefits and enhanced efficiencies. This may be used to teach anything from languages to math to practical skills like medical science, including pictures and animation to help students understand the subject better. Not just smart attendance gadgets but also whiteboards, integrated alarm systems in schools, assessment control tools, cameras, and school locks can be automated from the physical world to the central, system-based control world (Rathore et al., 2016; Klaib et al., 2021).

In the view of Demirkan et al. (2015), the Internet of Things (IoT) provides several key benefits for education, including: real-time data collection, communication, enhanced surveillance, global connectivity, flexibility, mobility, organization, preservation, and improved school management efficiency. A smart school (a school using IoT) fosters higher levels of personalized learning with smoothly functioning facilities. The smart devices used on a campus use the WiFi network to receive instructions and send data through digital technology. With these phenomenal advances in digital

technologies and ubiquitous computing, it is becoming increasingly important to introduce and train students, teachers, and college faculty to use the IoT, regardless of their specialty (Rose et al., 2015; Al-Garadi et al., 2020).

According to Yang et al. (2013) and Klaib et al. (2021) the Internet of Things (IoT) applications for higher education teaching and learning will aid in a variety of ways, including improved resource management, smarter class planning, workshop design, and information accessibility. They further identified examples and function of Internet of Things (IoT) applications in education to include the C-Pen, which helps to increase student involvement; cell phones with access to online dictionaries and the sauri; laptops and desktops for online research; and video and presentation creation software. The Magicard learning app stores all necessary data about students. Educational technology such as Promethean (Smart Board) interactive whiteboards and other displays, online assessment platforms, online classroom platforms, scan markers to convert handwritten notes into digital files without the need for manual transcription, and social media for both students and teachers Share Sweet Rush creates and evaluates curriculum materials and class discussions (Yang et al., 2013; Al-Garadi et al., 2020). It is on this basis that the paper focussed on some factors influencing the implementation of internet of things at classroom level in tertiary institution in Rivers State.

### **Statement of problems**

Internet of things as a network has come up with answers to enhance the quality of teaching and learning across the globe by making it easy to understand and available to all. IoT can be used for the improvement of classroom management and to improve the efficiency of teaching and learning for sustainable education in tertiary institution.

Recently, it has been observed that classrooms in tertiary institutions in Rivers State are limited from functional internet of things devices and this has hinder sustainable and effective teaching and learning. In some of the institutions, the facilities or device of internet of things are available, however, they are not used in teaching and learning. Some reasons have been attributed for non-utilization of internet of things devices in the state, lack of personnel, phobia for internet utilization. It is however against this backdrop that the paper is therefore centred on factors militating against Internet of Things utilization in classrooms in tertiary institution Rivers State

### **Objectives of the study**

The study is aimed at determining the factors militating against Internet of Things utilization in classrooms in tertiary institutions in Rivers State. Specifically, the study sought to determine:

1. how lack of ICT facilities influences the internet of things utilization in classrooms in tertiary institutions in Rivers State.
2. the influence of network connectivity/reliability on the internet of things utilization of classrooms in tertiary institutions in Rivers State.
3. the influence of ICT knowledge on internet of things utilization in classrooms in tertiary institutions in Rivers State.

### **Research Question**

The following research questions guide the study:

1. To what extent does lack of ICT facilities influence the internet of things utilization in classrooms in tertiary institutions in Rivers State?
2. To what extent does network connectivity/ reliability influence internet of things utilization in classrooms in tertiary institutions in Rivers State?
3. To what extent does lack of ICT knowledge influence the internet of things utilization in classrooms in tertiary institutions in Rivers State?

### **Hypothesis**

The following null hypotheses were formulated and tested in this study:

1. Lack of ICT facilities does not influence the internet of things utilization in classrooms in tertiary institutions. Rivers State
2. The network connectivity/ reliability do not influence the internet of things utilization in classrooms in tertiary institutions. Rivers State
3. Lack of ICT knowledge does not influence the internet of things utilization in classrooms in tertiary institutions. Rivers State

## **Literature Review**

### **ICT Competence of Instructors**

Competence is described as the ability to handle a diverse range of computer applications for a variety of reasons (van Braak et al., 2004). Teachers' computer competency is a strong predictor of technology adoption in the classroom (Anshari et al., 2017). According to the evidence, the majority of teachers who indicated a negative or indifferent attitude towards the integration of ICT into teaching and learning processes lacked the information and skills necessary to make "informed decisions". Peralta and Costa (2007) posit that technical competence influences Italian teachers' use of ICT in teaching. However, teachers identified pedagogical and didactic competencies as critical criteria for the implementation of successful and efficient educational activities. Teachers in Portugal expressed varying opinions about the most crucial ICT teaching competencies. The need for technical skills and attitude was emphasised by both experienced and new teachers, while curriculum and didactic competences were emphasised by innovative teachers, and student-teachers cited technical competence and pedagogical efficiency as important factors in integrating ICT into teaching and learning processes. According to Peralta and Costa (2007), teachers with more computer experience are more confident in their ability to use them effectively. Finally, Navarro et al., (2016) revealed that teachers' competency is directly related to their confidence. Teachers' confidence is also related to their judgments of their abilities to use computers in the classroom, particularly in contrast to the perceived competency of their children.

### **Computer and Network connectivity**

The revolution in computing and communications has radically changed the developed world. Information, which in the past was difficult or expensive to obtain, is now generally abundant and inexpensive (Kirkup & Kirkwood, 2005). People living in developed countries are now more likely to suffer from information overload than from information scarcity. In addition to producing new industries and markets, communications technology has revolutionized the way industries work. Transportation and finance, for example, would not be the industries they are today without existing high-speed communication and computing technology. The diffusion and adoption of these technologies have been driven in large part by rapid cost and performance decreases in microelectronics technology on the one hand and satellite technology, optical fibre technology, and packet switching techniques on the other (Sezer et al., 2017).

In developed countries, one of the driving forces is a well-established market for information products that can be delivered over high-bandwidth end-to-end networks, such as combinations of video, interactive computer services, telephony, and print delivery. The existence of and demand for such services make investment in upgrading the local loop attractive to telecommunications suppliers. In developed countries, robust markets for content or network services are the primary motivating force towards expanding digital connectivity (Pang et al., 2015; Al-Garadi et al., 2020).

## **METHODOLOGY**

A descriptive survey research design was used for the study. Osuala (2005) defined survey research design as the collection of detailed description of public opinion on the existing phenomena with the intent to justify current conditions and practices to make better plans for improving phenomena. The research was conducted at three tertiary institutions in Rivers State: Federal College of Education Technical Omoku, Ignatius Ajuru University of Education, and Rivers State University. The study's sample population included four hundred (400) students and lecturers obtained from three

institutions. A self-constructed questionnaire was used to collect the data. The instrument was titled "Factors Militating against Internet of Things utilization in Classrooms in Tertiary Institutions in Rivers State." The questionnaire consisted of two sections. Sections A and B Section A elicited information about the respondents' backgrounds, whereas Section B was divided into three (3) clusters: Cluster A dealt with the lack of ICT facilities and their influence on the use of internet of thing in the classroom, Cluster B dealt with network connectivity and its influence on the use of internet of things, and Cluster C dealt with the influence of knowledge ICT on the use of internet of thing in the classroom. The instrument was validated by two experts in the Department of Computer and Robotic Education and one expert in Measurement and Evaluation, all at Federal College Education (Technical) Omoku. The reliability of the instrument was determined using Cronbach's alpha, and a reliability coefficient of 0.86 was obtained. With the help of research assistants, the researcher visited the institution and distributed four hundred (400) copies of the validated questionnaire draught to the respondents. The researcher collected the completed questionnaires on the spot, while the rest were collected from the research assistants after they were completed. All of the questionnaires distributed were properly completed and collected, providing a response rate of 100%. Mean descriptive statistics and simple regression were used to analyse the collected data.

## **Presentation of Results and Discussions:**

### **Research Question 1**

To what extent does the lack of ICT facilities influence the internet of things utilization in classrooms in tertiary institutions Rivers State?

**Table 1: Lack of ICT Facility Influence use of Internet of Things in Classroom N=400**

S/no	Item on ICT Facilities & Internet of Things	X	SD	RMK
1	Lack of ICT facilities influences the use internet of things devices	3.19	0.77	A
2	ICT enhances the use of internet of things devices by instructors	3.44	0.63	A
3	There are internet of things devices in the ICT centres of the tertiary institutions	3.60	0.55	A
4	Internet of things devices and ICT skills can improve teaching & learning in the classroom	3.39	0.68	A
5	Availability of ICT and internet of things devices aids students participation of in the classroom	3.30	0.78	A
<b>Grand total</b>		<b>3.383</b>	<b>0.643</b>	<b>A</b>

The relationship between the lack of ICT facilities and the use of internet of things devices in the classrooms in tertiary institutions in Rivers State is depicted in Table 1. The outcome demonstrates that the lack of ICT facilities can affect the use of internet of things devices in classrooms in tertiary institutions in Rivers State. The grand total mean of 3.38 indicates that all the items stated in Table 1 were agreed to influence the use of internet of things devices in tertiary institutions. The findings align with those of Al Nuaimi et al. (2015), who researched the application of smart devices to learning, and Kardas and Tunali Savov et al. (2018) reported the computer vision and internet of things: attention system in educational context

### **Research Question 2**

To what extent do network connectivity/ reliability influence internet of things utilization in classrooms in tertiary institutions in Rivers State?

**Table 2: Network connectivity Influence on the use of internet of things  
N=400**

S/No	Item on computer competence & smart devices	X	SD	RMK
6	Lack of network connectivity influence internet of things	3.30	0.81	A
7	Network connectivity enhances internet of things classroom utilization	3.41	0.72	A
8	Teaching and learning is fast with network connectivity and internet of things	3.16	0.61	A
9	Network connectivity and internet of things aids class room participation by student	3.21	0.57	A
10	Classrooms without network connection and internet of things reduces student learning interest	3.50	0.61	A
<b>Grand total</b>		<b>3.32</b>	<b>0.66</b>	<b>A</b>

The relationship between network connectivity and the use of internet of things devices in classroom utilization in tertiary institutions in Rivers State is depicted in Table 2. The outcome demonstrates that network connectivity can affect the use of internet of things devices utilization in classrooms in tertiary institutions in Rivers State.

The result shows that classrooms without network connections and the internet of things reduce student learning interest and can make students passive during classroom learning. The grand mean of 3.318 indicates that network connectivity can militate against the utilization of internet of things devices and teaching and learning in tertiary institutions.

The findings were consistent with Liu et al. (2021), who reported on Internet of Things (IoT) technology for the development of intelligent decision support education platforms, and Amadeo et al. (2016), who reported on information-centric networking for the internet of things.

### Research Question 3

To what extent does lack of ICT knowledge influence internet of things utilization in classrooms in tertiary institutions in Rivers State?

**Table 3: Knowledge ICT Influence on the use of Internet of Things Devices  
N=400**

S/No	Item on ICT knowledge & Internet of Things devices	X	SD	RMK
11	Lack of ICT knowledge influences the use internet of things devices in classrooms	3.54	0.60	A
12	ICT knowledge and the availability of internet of things enhance classroom interaction in institutions	3.43	0.66	A
13	Most instructors are not ICT compliance, and therefore develop a phobia for internet of thing applications	3.24	0.63	A
14	Learning/teaching is faster in classroom fitted with internet of things	3.06	0.74	A
15	Knowledge of ICT sustains the use of the internet of things and students classroom interactions	3.20	0.90	A
<b>Grand total</b>		<b>3.29</b>	<b>0.65</b>	<b>A</b>

The relationship between knowledge of ICT and internet of things utilization in classrooms in tertiary institutions in Rivers State is depicted in Table 3. As a result, the lack of ICT knowledge enhances the use of the internet of things in classrooms. The findings also reveal that most instructors are not ICT-compliant and therefore develop phobias for internet-of-things applications. The results also report that knowledge of ICT sustains the use of the internet of things and students classroom interactions.

The grand mean of 3.292 affirms that knowledge of ICT influences internet of things utilization in classrooms in tertiary institutions in Rivers State. The finding is consistent with Peralta and Costata

(2007), who reported on teachers' competence and confidence regarding the use of ICT, and Sarkar (2012) who investigated the role of information and communication technology (ICT) in higher education for the 21st century.

### Hypothesis 1

Lack of ICT facility will not significantly impact the use of internet of things in classrooms in tertiary institution.

**Table 4: Lack of ICT Facility and use of internet of thing in classroom**

Model	ANOVA <sup>b</sup>			Model Summary			Coefficients <sup>a</sup>		
		Sum of squares	df	R	R <sup>2</sup>	Adj.R <sup>2</sup>	B	Beta	p-value
1	Regression	298.738	1	0.892 <sup>a</sup>	0.79	0.796	1.36	0.89	0.000
	Residual	76.377	398		6		0	2	
	Total	375.115	399						
	F=1.518E3, Mean-square=298.738, sig.=0.000 <sup>a</sup>			Std. Error of the estimate=0.4437, sig.=0.000			t=38.957, $\alpha$ -level=0.05		

The analysis of the lack of ICT facilities and the use of the internet of things in classrooms in tertiary institutions is depicted in Table 4. The R value, which represents the relationship between the lack of ICT facilities and the use of internet of things utilization in classroom, has a value of 0.892a, indicating that the regression model best explains the relationship between the lack of ICT facilities and the use of internet of things in the classroom in tertiary institutions.

The total variance in the use of the internet of things in classrooms in tertiary institutions due to the influence of a lack of ICT is 0.796. Based on the adjusted R<sup>2</sup> of 0.796 and the standard error of 0.4437, the availability of ICT contributes 79.6% to the use of internet in the classroom in tertiary institutions. The ANOVA in Table 4 demonstrates that the relationship between the lack of ICT and internet of thing in classrooms in tertiary institutions is significant enough to be explained in the model. The standardized B coefficient has a positive value of 1.360, which suggests that there is a correlation between the lack of ICT and the internet of thing in classrooms in tertiary institutions. The null hypothesis was rejected on the basis of the assumption that the statistical probability is less than the 0.05  $\alpha$ -level. The findings were supported by Ding et al. (2020), and Siddiquah and Salim (2017), who investigated the ICT facilities, skills, usage, problems faced by students of higher education, and different applications of ICT and the internet of things.

### Hypothesis 2

The network connectivity/ reliability does not influence the internet of things utilization in classrooms in tertiary institution Rivers State

**Table 5: Network connectivity/ reliability and the Use of internet of things in classrooms in tertiary institution**

Model	ANOVA <sup>b</sup>			Model Summary			Coefficients <sup>a</sup>		
		Sum of squares	df	R	R <sup>2</sup>	Adj.R <sup>2</sup>	B	Beta	p-value
1	Regression	299.308	1	0.893 <sup>a</sup>	0.79	0.797	1.44	0.89	0.000
	Residual	73.806	398		8		0	3	
	Total	375.115	399						
	F=1.532E3, Mean-square=299.308, sig.=0.000 <sup>a</sup>			Std. Error of the estimate=0.4420, sig.=0.000			t=39.140, $\alpha$ -level=0.05		

Table 5 illustrates the analysis of network connectivity and the use of the internet of things in classrooms in tertiary institutions in Rivers State. The R value of 0.893<sup>a</sup>, which depicts the relationship between network connectivity and the use of the internet of thing in classroom, is best described by a linear regression.

The total variance in the use of the internet of things in classrooms in tertiary institutions in Rivers State owing to the influence of network connectivity is 0.798. Network connectivity provides 79.7% of the use of internet things in classrooms in tertiary institutions in Rivers State, based on an adjusted R<sup>2</sup> of 0.797 and a standard error of 0.4437. The ANOVA in Table 4 reveals that the model adequately explains the relationship between network connectivity and the use of the internet of thing in classrooms in tertiary institutions. The standardized B coefficient has a positive value of 1.440, indicating that there is a correlation between network connectivity and the use of the internet of thing in classrooms in tertiary institutions. The null hypothesis was rejected because the statistical probability was less than the 0.05 significance level. The result is in agreement with Pelletier et al. (2011), Shi et al. (2021), who worked on the Internet of things application of intelligent and innovative learning strategies in the higher English education system.

### Hypothesis 3

The lack of ICT knowledge does not influence the internet of things utilization in classrooms in tertiary institution Rivers State?

**Table 6: lack of ICT knowledge and the Use of internet of things in classroom**

Model	ANOVA <sup>b</sup>			Model Summary			Coefficients <sup>a</sup>		
		Sum of squares	df	R	R <sup>2</sup>	Adj.R <sup>2</sup>	B	Beta	p-value
1	Regression	313.248	1	0.914 <sup>a</sup>	0.83	0.835	1.38	0.91	0.000
	n				5		0	4	
	Residual	61.867	398						
	Total	375.115	399						
	F=1.965E3, Mean-square=313.248, sig.=0.000 <sup>a</sup>		0.159,	Std. Error of the estimate=		of the t=44.323, $\alpha$ -level=0.05			
				0.3993,		0.3993,			
				sig.=0.000					

The analysis of the lack of ICT knowledge and the use of the internet of things in classrooms in tertiary institutions in Rivers State is shown in Table 6. The linear regression provides the clearest picture of the relationship between ICT knowledge and the use of the internet of things in classrooms in tertiary institutions in Rivers State, which has an R value of 0.914<sup>a</sup>.

A total of 0.835 variations in the use of the internet of things in classrooms in tertiary institutions can be attributed to the influence of a lack of ICT knowledge. Based on an adjusted R<sup>2</sup> of 0.835 and a standard error of 0.3993, lack of ICT knowledge influenced the use of the internet of things in classrooms in tertiary institutions by 83.5%. According to the ANOVA in Table 6, the model successfully explains the connection between the use of the internet of things in classrooms in tertiary institutions and a lack of ICT knowledge. In the use of the internet of things in classrooms in tertiary institutions in Rivers State, the standardized B coefficient has a positive value of 1.380, demonstrating a correlation between a lack of ICT knowledge and the use of the internet of things in classrooms. Because the statistical probability was below the 0.05 significance level, the null hypothesis was rejected. The findings were consistent with those of Navarro et al. (2016), who worked on a framework to evaluate m-learning systems through a technological and pedagogical approach. Also, the finding is in line with Adedoja et al. (2016), who researched learners' acceptance of the use of mobile phones to deliver tutorials in a distance learning context. This therefore implies that a lack of ICT knowledge is among the factors influencing the use of the internet of things in classrooms in tertiary institutions in Rivers State.

## **CONCLUSION**

The study reports the factors militating against Internet of Things utilization in classrooms in tertiary institutions in Rivers State. The basis of the study was to investigate factors responsible for the lack of implementation of IoT in classrooms in tertiary institutions, despite the fact that it can improve the efficiency of teaching and learning for sustainable education in tertiary institutions. The findings reveal that the lack of ICT facilities, network connectivity, and knowledge of ICT are the major factors militating against Internet of Things utilization in classrooms in tertiary institutions in Rivers State. As a result, teaching and learning are made easy and accessible with the use of the internet in the classrooms of tertiary institutions in Rivers State.

It was therefore important for tertiary institutions to incorporate the internet of things in the classrooms in order to improve teaching and learning generally.

## **RECOMMENDATIONS**

The following recommendations are therefore made:

1. The government of Rivers State should provide adequate funds to procure the ICT facilities required for effective implementation of the internet of things in the classrooms.
2. Tertiary institutions in Rivers State should provide and upgrade personnel with ICT knowledge.
3. Tertiary institutions in Rivers State should organize orientation programmes for instructors and students in order to enable them to effectively align with the functions and network connectivity of the internet of thing.

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