Utilization of Internet Things (IOT) for Implementing Teaching and Learning in Technical Colleges in Enugu State

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ABSTRACT

The purpose of this study was to determine the utilization of internet of things (IoT) for implementing teaching and learning in Technical colleges in Enugu State. Two research questions and hypothesis guided the study. A descriptive survey research design was adopted to carry out the study. The population for the study was one hundred and sixty (160) respondents, comprising 137 students and 23 teachers of both Technical Colleges. Two questionnaires titled level of IoT utilization by teacher for teaching and the level of IoT utilization by students for learning were developed by the researchers and used for data collection. Three experts validated the instruments, two experts from the Department of Industrial Technical Education, University of Nigeria, Nsukka and one expert from the Department of Vocational Education, School of Technical Education, Yaba College of Technology. The reliability co-efficiency of the instrument was found to be 0.86 and 0.73. Data collected were analyzed using mean and standard deviation to answer the research questions, while t-test statistics was used to test the hypotheses at 0.05 level of significance. The study found significant response between male and female on utilization of internet of things (IoT) for implementing teaching and learning in Technical College's in Enugu State. It was discovered that poor utilization and un updated IoT in technical colleges hinders IoT implementation for teaching and learning in technical colleges in Enugu state, hence, the utilization of IoT for implementing learning and teaching are impeded.

Keywords: Technical colleges, Internet of Things (IoT), Teaching and Learning

INTRODUCTION

The vast development and cumulative role of technology in all our daily activities, conventional and classical methods of education in the classroom are no more attractive and efficient for the learners of the 21st century. Due to the application of technology, the world of education is currently undergoing drastic changes (Ferguson, 2021). Students are getting more interested in self-directed, self-paced learning; they are willing to use innovative learning methods; the role of the teacher is becoming more consultative; and now schools are realizing the significance of introducing and applying technologies into their daily teaching and learning methods, such as the Internet of Things (IoT).

The IoT concept was coined by a member of the Radio Frequency Identification (RFID) development community in 1999, and it has recently become more relevant to the practical world, largely because of the growth of mobile devices, embedded and ubiquitous communication, cloud computing, and data analytics. The Internet of things refers to a type of network that connects anything with the Internet based on stipulated protocols through information sensing equipment to conduct information exchange and communications in order to achieve smart recognition, positioning, tracing, monitoring, and administration (Patel et al., 2016). The Internet of Things is basically a network of several devices that are connected by

miscellaneous software, electronics, and network connectivity of distinct orientations aimed at exchanging and compiling any kind of information (Savaram Ravindra, 2018). According to a study by Global Standard Initiatives (2015) in (Amadin, 2017) IoT is said to be a network of physical devices, objects, buildings, vehicles, and other items which are embedded with electronics, software, sensors, and network connectivity that support these objects to collect and exchange data. On the other hand, the IoT is the connection of physical things to the internet thereby creating channels to access remote sensor data and control the physical world from a distance (Kopetz, 2011) in (Amadin, 2017).

The Internet of Things (IoT) is an international network that combines things and materials with the Internet to support interactive communication with the environment. Imagine a world where billions of objects can sense, communicate, and share information, all interconnected over public or private Internet Protocol (IP) networks. These interconnected objects have data that is regularly collected, analyzed, and used to initiate action, providing a wealth of intelligence for planning, management, and decision making. The Internet of Things (IoT) is a network of physical objects; that is, the internet has evolved into a network of devices of all types and sizes: vehicles, smart phones, home appliances, toys, cameras, medical instruments, industrial systems, animals, people, and buildings, all connected, all communicating and sharing information based on specified protocols in order to achieve smart organization, positioning, tracing, safety, and security. IoT is applied in different sectors such as transportation, marketing, health, telecommunications, education, etc.

In education, IoT has enhanced learning and teaching by providing advanced value to the structures and environment of education. Also, the education sector is one of the most adaptive and effective in terms of deploying IoT devices for its usage in order to make education more collaborative, interactive, and accessible to all. With IoT devices, students can use smartphones and PDAs to access their homework assignments and test results through online portals. Video can be uploaded to the cloud. Online video conferencing enables students to attend classroom lectures remotely. IoT devices are used to track students who skip their classes, send alerts to help students concentrate on academic work regularly, and find lost personal items (Faritha Banu et al., 2020). IoT gives teachers the ability to measure student learning progress in real-time and also provides solutions for smart and sustainable campuses to improve the learning methods of students and increase the efficiency of everyday activities in the institution. The IoT enables the shift in teaching methodology from traditional to digital, with several additional benefits and increased efficiency. This can be used for teaching all subjects, ranging from languages to maths, to teaching practical skills like medical sciences, with the use of graphics and animation to improve a better understanding of the subject matter. Not just these smart attendance devices, boards, integrated alarm systems in schools, assessment checking tools, cameras, school locks, everything can move from the physical world to the central system-based control world with automation. IoT has several important benefits for education, including: real-time data collection, communication, improved monitoring, global interconnectedness, flexibility, mobility, organization, conservation, telepresence technology, and improved school management efficiency. A smart school (a school that uses IoT), with its facilities operating smoothly, promotes a higher level of personalized learning. The smart devices used on a campus utilize the WiFi network for receiving instructions and sending data through digital technology. With these phenomenal advancements in digital technologies and ubiquitous computing, it is becoming mandatory to introduce and train our students, teachers, and instructors on the utilization of IoT regardless of their core areas of specialization in technical colleges.

In technical colleges, students who are currently enrolled must be of the utmost importance in preparing these students for these technologies. Companies will be looking for candidates who will be equipped with knowledge of the latest state-of-the-art technologies. Also, technical colleges can be potentially transformed by profoundly altering how data is gathered. In technical colleges, the stored data can be used to improve decision-making processes. With the help of this data, a teacher can also get a more accurate picture of the current state of assessing the students than before. IoT should be integrated into technical colleges because it

will help to achieve important educational objective and also motivate, promote curiosity-learning and ease research work. The safety of the technical college environment, self-directed learning, effective learning, and improving the efficient use of educational resources (Vihervaara & Alapaholuoma, 2017).

The IoT applications for teaching and learning in technical colleges will help to keep track of major resources, create smarter lesson plans, design secure workshops, enhance information access, and much more. Some of the applications of IoT in learning and teaching include: C-Pen for improving student engagement, Smartphones for online dictionaries and thesaurus Laptops and desktops for online research or software for creating videos, slide shows, or LocoRobo for improving teaching efficiency. The educational app, Magicard, is used to collect all relevant student data. Promethean (smart board) interactive boards and other displays for schools, online assessment platforms, online classroom platforms, Scanmarker for students and teachers to scan physical notes into digital files without the need to transcribe them by hand, social media for students to research and teachers to share lesson plans and for group discussion, Sweetrush designs, builds, and tests education solutions for mobile and e-learning. Tablets for online dictionaries, thesaurus reading files, Digital projectors for teaching, Kaltura's video management and creation tools enable students and teachers in and out of the classroom to create, edit, and deliver live or on-demand high-quality video to any device. With the set of these advanced tools, IoT can be used for the improvement of classroom management and to improve the efficiency of teaching and learning for sustainable education in technical colleges.

Thus, IoT solutions have 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. Regarding the IoT advantages and vast area of operation, this is worth investing in technical colleges. A lot of educational platforms are recently surfacing, and that's solely because IoT enabled devices and software to come with features that extended teaching and learning opportunities on convenient, easy-to-use, and safe platforms for teachers and students. Considering the importance of the internet of things (IoT) to education, it is therefore essential to incorporate IoT into technical colleges' curriculum to aid the effectiveness and efficiency of its delivery. This study therefore seeks to assess the utilization of the internet of things (IoT) for implementing teaching and learning in technical colleges.

Statement of the problem

IoT is the network of physical devices, objects, buildings, vehicles, and other items that are embedded with electronics, software, sensors, and network connectivity that support these objects to collect and exchange data. IoT 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 technical colleges. Technical colleges in Enugu state have limited or non-functioning IoT devices and internet facilities required for sustainable and effective teaching and learning because of their lack of awareness and unavailability of some devices and internet facilities. There is also a lack of qualified or trained personnel to operate the available devices, as well as a high cost of purchasing, maintaining, and replacing the devices. It thus appears that, therefore, technical colleges in Enugu State lack the required IoT for implementing teaching and learning. It was based on this background that this study was carried out to examine the utilization of the internet of things (IoT) for implementing teaching and learning in technical colleges in Enugu state.

Purpose of the study

The purpose of the study is to determine the utilization internet of things (IoT) for implementing teaching in technical colleges in Enugu State Specifically, the study identified:

1. The level of IoT utilization by teachers for teaching in technical colleges in Enugu state.
2. The level of IoT utilization by learners for learning in technical colleges in Enugu state.

Research questions

The study sought to answer the following research:

1. What is the level of IoT utilization by teachers for teaching in technical colleges in Enugu state?
2. What is the level of IoT utilization by learners for learning in technical colleges in Enugu state?

Hypotheses

The following null hypothesis will be tested at 0.05

1. There is no significant difference in the mean responses of male and female teachers on the level of IoT utilization for teaching in Technical colleges in Enugu state.
2. There is no significant difference in the mean responses of male and female students on the level of IoT utilization for learning in Technical colleges in Enugu state.

METHODOLOGY

The study adopted a survey research design. The area of the study was Enugu State and it was conducted in two public technical colleges. The population for the study is 160. This consist of 137 students and 23 teachers of technical education from both technical colleges. Since the numbers of students and lecturers were not too large, the entire population was used because it was manageable for the study. Two structured questionnaires were developed by the researchers and used for data collection in this study: the Utilization Level of IoT by Teachers Questionnaire (ULITQ) and the Utilization Level of IoT by Students Questionnaire (ULISQ). The utilization level of IoT by the teachers' questionnaire was divided into two sections, Section A and Section B. Section A contains items that seek demographic information from the teachers. Section B consists of 11 items that seek to assess the level of IoT utilization by teachers. The items were based on a four-point rating scale of Very Highly Utilized (VHU), Highly Utilized (HU), Moderately Utilized (MU), and Not Utilized (NU) with values of 4, 3, 2, and 1 respectively.

This instrument had a reliability co-efficient level of 0.86 and 0.73. The level of IoT utilization by students in the questionnaire was also divided into two sections, Section A and Section B. Section A contains items that seek demographic information from the students. Section B consists of 14 items that seek to assess students' utilization of IoT for learning. The items were based on a four-point rating scale of Very Highly Utilized (VHU), Highly Utilized (HU), Moderately Utilized (MU), and Not Utilized (NU) with values of 4, 3, 2, and 1 respectively. This instrument had a reliability value of 0.86 and 0.73. The instruments were validated by three experts. Two experts from the Department of Industrial Technical Education, University of Nigeria, Nsukka, and one expert from the Department of Vocational Education, School of Technical Education, Yaba College of Technology, The expert made some inputs that were integrated to improve the final copy of the instrument.

The reliability of the study was determined using the Cronbach Alpha method. The instruments were trial tested on technical college lecturers and students in Ebonyi State. The data was collected by administering the questionnaire directly to the respondents by the researcher and two research assistants. Data collected were analyses were carried out using SPSS statistical package. Mean and Standard deviation was used to answer the research questions, while a t-test was used to test the hypothesis at a 0.05 level of significance.

Any item with a mean value of 2.50 – 4.00 was considered utilized, while any item with a mean value of 0.00- 2.49 was considered not utilized. For the test of significance, the probability (p) value was used in comparison with the alpha value of.05 and at other relevant levels. If any item has a probability value greater than.05 (P > 0.05), it will be concluded that there is no significant difference in the mean responses of the respondents.

RESULTS

Table 1:

Mean and Standard Deviation Response of IoT utilization by Teachers for Teaching in Technical Colleges in Enugu State

S/N	Utilization level of IoT (device and software) for teaching	$\bar{x}$	SD	Decision
1	Level of Smart phone utilization for enhancing teaching	2.66	0.87	HU
2	Utilization of robots for teaching	1.43	0.75	NU
3	Level of utilizing smart board for teaching	1.56	1.07	NU
4	Utilization level of Educational app for teaching	2.21	0.81	MU
5	Utilization level of digital projector for teaching	2.05	0.86	MU
6	Utilization level of Laptops for teaching	3.13	0.71	HU
7	Level of utilizing WIFI/internet connection for teaching	1.82	0.81	NU
8	Intensified utilization of level of Tablet for enhancing teaching	2.48	0.85	MU
9	Utilization level of online classroom for teaching	1.31	0.97	NU
10	Utilization level of social media for presenting lesson plan and teaching	1.97	0.87	NU
11	Level of utilizing E-learning environment for teaching	2.04	0.79	NU

Note;$\bar{x}$= Mean, SD= Standard deviation, VHU = Very highly utilized, H = Highly utilized, MU=Moderately utilized, NU = Not utilized

Data presented in Table 1 shows that six IoT items with mean values from 1.31 – 2.04 are not utilized, by teachers for teaching in technical colleges in Enugu state, while five IoT items with a mean value from 2.05 – 3.13 are utilized by teachers for teaching in technical colleges in Enugu state.

Table 2:

Mean and Standard Deviation Response of IoT utilization by learners for learning in technical colleges in Enugu state

S/N	Utilization level of IoT (device and software) for learning	$\bar{x}$	SD	Decision
1	Level of use of an online classroom for learning	1.55	0.71	NU
2	Level of utilization of social media for enhancing learning	2.98	0.54	MU
3	Level of smart phone utilization for learning.	3.55	0.98	HU
4	Utilization level of Educational app for reading and research work	3.60	0.79	MU
5	Utilization level of Laptops for online reading and tutorial	3.72	0.61	HU
6	Intensified use of WiFi/internet connection for research work and assignment	2.90	0.66	NU

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7	Utilization of level of Tablet for reading document and file	1.64	0.80	NU
8	Utilization level of online classroom for group discussion and lectures	2.39	0.86	NU
9	Utilization level of Scanmaker to scan physical note into digital files	2.29	0.89	NU
10	Level of desktop utilization for video design, graphics reading etc	1.65	0.71	NU
11	Utilization level of cloud storage to retrieve information for solving educational problem and research works.	1.77	0.88	NU
12	Level of using an E-learning environment for learning and research	1.52	0.75	NU

Note; $\bar{X}$ = Mean, SD= Standard deviation, VHU = Very highly utilized, H = Highly utilized, MU=Moderately utilized, NU = Not utilized.

Data presented in Table 2 shows that four IoT items with mean values from 2.98 – 3.72 are utilized by learners for learning in technical colleges in Enugu state, while eight IoT items with a mean value from 1.52 – 2.39 are not utilized by learners for learning in technical colleges in Enugu state.

Table 3:

The t-test Analysis of the Mean Responses of the Male and Female Respondents on the IoT utilization by Teachers for Teaching in Technical Colleges in Enugu State

S\N	Electronic Records Creation Practice	df	t-cal	X_1 (male)	X_2 (female)	Sig.	Remarks
1	Create data on spread sheets and database applications	19	1.198	3.541	3.375	0.234	NS
2	Generate and use electronic mail	19	0.335	3.000	2.964	0.738	NS
3	Apply suitable format to types of documents	19	0.722	3.270	3.410	0.472	NS
4	Do not Create and organize computer files and folders	19	0.341	3.625	3.571	0.734	NS
5	Do not Change font type, style and size in a document	19	0.122	3.729	3.714	0.903	NS
6	CreatePowerPoint graphics/slides of business products to be sent online (Electronic marketing	19	0.389	2.229	2.178	0.698	NS
7	Using computer aided design such as digital camera, touch screen, trackballs etc for records creation	19	0.226	1.625	1.660	0.822	NS
8	Opening and working with more than one application at a time (multi –tasking) for records creation	19	0.349	3.416	3.357	0.728	NS
9	Use word Art in a document	19	0.628	3.229	3.339	0.531	NS
10	Placing and confirming orders online (electronic marketing)	19	0.512	2.250	2.321	0.609	NS
11	Manipulate hardware devices like printer, scanner, digital camera and projector to create electronic records	19	1.090	2.666	2.857	0.275	NS

Table 3 shows that all the 11 items had their significant value to be greater than .05 (P>0.05). This indicated

that, there was no significant difference between the mean responses of male and female teachers on the level of IoT utilization for teaching in Technical colleges in Enugu state therefore the hypothesis which stated that there is no significant difference in the mean responses of male and female teachers on the level of IoT utilization for teaching in Technical colleges in Enugu state was accepted.

Table 4:

The t-test Analysis of the Mean Responses of the Male and Female Respondents on the IoT utilization by Learners in Technical Colleges in Enugu State

S\N	Electronic Records Creation Practice	Df	t-cal	X_1 (male)	X_2 (female)	Sig.	Remarks
1	Level of use of an online classroom for learning	133	2.138	2.687	3.000	0.095	NS
2	Level of utilization of social media for enhancing learning	133	0.000	2.000	2.000	0.992	NS
3	Level of smart phone utilization for learning.	133	0.585	3.437	3.339	0.560	NS
4	Utilization level of Educational app for reading and research work	133	1.942	3.541	3.160	0.055	NS
5	Utilization level of Laptops for online reading and tutorial	133	0.990	3.000	3.142	0.324	NS
6	Intensified use of WiFi/internet connection for research work and assignment	133	2.733	2.416	1.982	0.067	NS
7	Utilization of level of Tablet for reading document and file	133	1.749	3.562	3.750	0.083	NS
8	Utilization level of online classroom for group discussion and lectures	133	1.649	1.937	2.214	0.102	NS
9	Utilization level of Scanmaker to scan physical note into digital files	133	2.604	2.895	2.464	0.111	NS
10	Level of desktop utilization for video design, graphics reading etc	133	1.579	3.750	3.517	0.117	NS
11	Utilization level of cloud storage to retrieve information for solving educational problem and research works.	133	2.355	2.854	3.250	0.070	NS
12	Level of using an E-learning environment for learning and research	133	1.257	3.104	3.303	0.212	NS

Table 4 shows that all the 12 items had their significant value to be greater than .05 (P>0.05). This indicated that, there was no significant difference between the mean responses of male and female learners on the level of IoT utilization for learning in Technical colleges in Enugu state therefore the hypothesis which stated that there is no significant difference in the mean responses of male and female students on the level of IoT utilization for learning in Technical colleges in Enugu state was accepted

DISCUSSION OF FINDING

The results of the study reveal that the level of utilization of the internet of things (IoT) for implementing

teaching and learning in technical colleges in Enugu state by teachers and learners is low or not utilized. The finding further revealed that the technical college teachers and students are not aware of some IoT devices based on the responses of the respondents. This is in agreement with a study conducted by Csotos et al. (1998) in (Amadin, 2017) where the citizens indicated that they are not aware of the numerous kinds of technology provided for them. This poor awareness has created many misconceptions about the true value of this technology.

The findings of the study also reveal that the attempt to implement IoT into technical colleges has faced a lot of challenges, such as the cost of IoT and financing, a dearth in technical college teachers, the unsure prospect of IoT application to technical colleges, and problems in the job situation (where there is no emphasis on computer literacy), poor electricity supply, poor availability of trained personnel, etc. Although some of the technical colleges in Enugu state have some of the technology, the fact remains that some of them are not functional as a result of many obstacles. This finding of the study was in support of Adejoh Ozoii (2005) in (Otunola, 2020), where he stated that some of the obstacles to the utilization of ICTs in teaching and learning include: low level of ICT literacy among teachers, dearth of technical staff, low level of funding, irregular power supply, high cost of ICT facilities, and lack of relevant ICT infrastructures. Irregular power supply is another hitch to implementing IoT in a technical college. Even when certain handsets can be used to browse, not all the needed information can be freely downloaded without much cost. These definitely limit students' and teachers' utilization of IoT.

CONCLUSION

Based on the data analyzed and findings made, it was concluded that the utilization of IoT by teachers and students in technical colleges in Enugu states is low. It was also observed that due to unavailability and poor awareness of IoT also contributed to the low / poor utilization. Also students and teacher who has personal IoT device are not utilizing it effectively due to the epileptic power supply in the area

RECOMMENDATIONS

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

1. The government is urged to do more to promote IoT development and adoption by being a lead adopter of the IoT in education ministries/agencies.
2. Government and school authorities should provide IoT device to enable the students to access the internet easily.
3. Government and school should provide efficient power supply for teacher and student in their schools in other to make use of available IoT devices effectively.
4. Authorities should provide enabling environment and strict adherence to best practices toward IoT in technical colleges for effective utilization.

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