Adoption and use of Information and Communication Technologies by teachers in selected vocational and technical colleges in Lagos State, Nigeria

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This study was designed to examine the adoption and use of information and communication technologies by teachers in Selected Vocational and Technical Colleges in Lagos State, Nigeria. Data was collected from 90 VTE teachers out of a sample of 105. The variables were created based on UTAUT theory. Principal component analysis was used to reduce the dimensions of each of the constructs in the model. The relationship between performance expectancy and adoption of ICT variables of using information technology services to improve job performance is very small, and negative but significant (B=-0.14, t=-0.257, p<0.000). Using information technology to improve teacher performance and adoption of ICT yielded a similar result. But the reverse is the case for using information technology to improve teaching efficiency (B=0.248, t=1.786, p=0.19). The correlation coefficient of the relationship between the availability of ICT tools and the adoption of ICT is relatively low (r=0.392, p<0.05). Furthermore, the regression coefficient between effort expectancy and adoption of ICT is not significant, but the situation is different for the availability of a specific person or group available for assistance with any technical problem. Self-efficacy variables also predicted the adoption and use of ICT. Generally, the ICTs were available but not as much accessible. The implementation of ICT in the VTE colleges in Lagos would benefit from a wider scope study, with an examination of factors other than those of UTAUT.

Keywords: information technology, vocational education, technical colleges, Nigeria

1 Introduction and background

The fourth target of the United Nations' Sustainable Development Goals (SDG) (2015) is "… to substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship by 2030." (UNDP 2015). Vocational and technical education (VTE) plays a critical role in the technological advancement of any economy because training and acquisition of relevant skills and their utilization are very crucial for national economic growth and development. Ogbuanya and Arimonu (2015) opined that there is a need to equip the youths with the essential viable knowledge and skills for surviving in a hostile environment. These knowledge and skills are acquired through occupational preparations offered by VTE (Okoye & Arimonu 2016). According to Nigerian National Policy on Education (2004), VTE is concerned with the development of qualitative technological human resources directed towards creating a pool of national skilled and self-reliant, technicians, craftsmen, and technologists in vocational and technical education fields.

Vocational education has been an integral part of the development of national plans globally because of its ability to lead to the acquisition of scientific knowledge and skills that are practical. One of the ways of addressing this observation is in the teaching and learning of technical subjects that demands the engagement of the students in practical work, especially with using information and communication technologies. In December 2000, the Federal Government of Nigeria and UNESCO signed a Project Document and Plan of Action to support the first phase of the revitalization of technical and vocational education in Nigeria.

One of the objectives of this phase is to partner with the Federal and State Education authorities in their efforts to invigorate, reform, and enlarge VTE programs to meet the needs for rapid socio-economic development needs of the country. One of the key elements in that plan was the introduction of information and communication technologies into vocational and technical education and training. Under goal 17 of the UN International Policy Framework, the critical role of ICT for nation-building is aptly recognized. Through the effective incorporation of ICT into the national framework, the UN envisages the enhancement of international cooperation to improve access to science, technology, and innovation (UNESCO 2015).

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The rapid advances of information and communication technologies have radically changed the educational sector by making teaching and learning to be more flexible. Integrating ICT in the teaching and learning in VT colleges could create the required enabling learning environments because learners may develop interests in carrying out tasks and accessing and using various materials and resources that abound in several sources. Shamim and Raihan (2016) conducted a study on the effectiveness of ICT use in the promotion of teaching and learning in technical education in Bangladesh. They found that ICT facilitated teaching and learning, and that ICT saves time in comparison with the traditional teaching approaches. They also found that ICTs offer many benefits to the general educational system, whether the consideration is in teaching and learning, student assessments or management. Adoption and use of ICTs by vocational teachers in the delivery of education will help in promoting efficiency and credibility in teaching and learning. Utilizing ICTs in the classrooms could greatly help vocational teachers to facilitate the delivery of complex subjects, thus enabling students to acquire requisite skillsets in such subjects.

The usage of ICT in vocational training centres can bridge the gap in knowledge between students and teachers because of the flexibility the usage of ICTs offers. Bindu (2016) observed that using ICT will help learners to communicate, and share ideas without any interruption, and also, they could also work as a team from anywhere and at any time. The range of facilities that can help achieve this includes teleconferencing which connects remotely located students to meet for discussions on related topics with colleagues and teachers. In these circumstances, students acquire collective knowledge, and they also share their learning experiences, thus empowering them to freely express themselves and envision their learning. Using ICT can only impact learning when the teachers have adequate digital literacy that enables them to understand how they could integrate ICTs into their school curriculum. Besides teachers' ability and skills, ICTs need to be available and accessible for the teachers to use. While Dasgupta's (2008) definition of ICT adoption as the decision to accept or invest in information and communication technology, ICT use is about how ICTs technology is integrated into the curriculum for use for the purpose of impacting learners' understanding of what teachers teach.

Several factors constitute hindrances to the adoption and use of information and communication technology by vocational teachers in the technical colleges in Nigeria. These factors include personal and external factors. Personal factors are those factors that relate to the individuals and their characteristics while external factors are those that are concerned with issues beyond the control of the individual. Personal factors include age, gender and educational status, among others, while external factors include policy issues such as availability and accessibility of the technology. Oso (2015) has stated that "Observation has shown that Nigerian Government has not given Vocational Education the attention it deserves due to the changes in world economy emphasis which has shifted from training for the lifelong profession to training of computers and information technology". Momoh (2012) observed earlier that the government's lack of commitment to technical education and inadequate funding have weakened technical education performance in Nigeria.

2 Research problem

Vocational and technical education has a place in Nigeria's national policy on education, but studies addressing the role of information and communication technologies have not been carried. Examining how teachers adopt and utilize ICT for teaching and learning could be the starting point in understanding and implementing ICT in VTE institutions in Nigeria. As already established in the literature, ICT is the confluence of all technologies, and fruitful technology implementation and use cannot be achieved in the absence of adequate place for the roles of ICT.

3 Purpose of the study

The purpose of this study was to investigate how teachers at technical colleges in Lagos State, Nigeria, adopt and use ICT to facilitate teaching, learning, and learning assessment in the college. The objectives are to:

- Examine the performance expectancy in the adoption and use of ICT by vocational teachers in technical colleges in Lagos state.
- Investigate the effort expectancy in the adoption and use of ICT by vocational teachers in technical colleges in Lagos state.
- Investigate the facilitating conditions to the use of ICT by vocational teachers in technical colleges in Lagos state.
- Examine the computer self-efficacy of vocational teachers in technical colleges in the adoption and use of ICT.
- Examine the availability and accessibility of ICT for use by vocational teachers in technical colleges in Lagos state.

4 Statement of hypotheses

- H01: There is no significant relationship between performance expectancy and the adoption of ICT by vocational teachers in technical colleges in Lagos State, Nigeria.

- H02: There is no significant relationship between the availability of ICT tools and the adoption of ICT by vocational teachers in technical colleges in Lagos State, Nigeria.
- H03: There is no significant relationship between effort expectancy and the adoption of ICT by vocational teachers in technical colleges in Lagos State, Nigeria.
- H04: There is no significant relationship between facilitating conditions and the adoption of ICT by vocational teachers in technical colleges in Lagos State.
- H05: There is no significant relationship between computer self-efficacy and the adoption of ICT by vocational teachers in technical colleges in Lagos State.

Information and communication technologies are the fulcrum of the convergence phenomenon, that is, all existing technologies, their design, use, and applications revolve around ICTs. This observation is important of vocational and technical education being moored to information and communication technologies. This study contributes in unveiling the extent to which the vocational and technical schools are embracing information and communication technologies by looking at teachers' adoption and use of the technologies.

5 Literature review

Technical and vocational education prepares individuals to be gainfully self-employed through the acquisition of relevant knowledge, skills, and experiences and the application of the acquired skills for technological advancement. Vocational and Technical Education is a comprehensive term that refers to those aspects of the education process that involves the study of technologies, related science subjects, and the acquisition of practical skills and attitudes, as well as understanding and knowledge related to occupations in the various sectors of the economic and social life of a nation, in addition, to general education. According to the UNESCO's Revised Recommendation concerning Technical and Vocational Education: Technical and Vocational Education is "… used as a comprehensive term referring to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life." (UNESCO 2001).

According to Onyeizu (2020), vocational and technical education is a form of education that has the primary purpose of preparing persons to be employed in recognized occupations. According to this author the terms technical education and vocational education can be used interchangeably although they could be considered separate and distinct terms. Generally, vocational education is used to refer to programs that are skill-based and designed to facilitate skill acquisition at lower levels of education. The essence of vocational education programs is to focus on specific vocations that qualify people for entry into defined workplaces. On the other hand, technical education is not designed for any specific vocation, but it provides general technical knowledge to individuals about specific skills and professions. Technical education, therefore, is aimed at preparing people for entry into occupations at higher levels, but usually for people that belong to lower than the first-degree category. Technical and vocational education results from the merger of basic technical and scientific knowledge with skill-based vocational programs (Okoye and Arimonu2016). According to Uwaifo (2009), technical educators are trained to be initiators, facilitators, and implementers of technological development in any nation. Usually, the training of citizens to be literate technologically would always eventually lead to some degree of self-reliance and sustainability. Uwaifo also observed that technical education has a direct impact on the development of the country compared with any other profession.

Technical colleges are centres of learning that specialize in practical training in those courses that are related to Vocational and Technical Education. Technical Colleges admit students who have completed the trade schools' courses, and they offer a full range of vocational courses that have three years duration. Students could be transferred from secondary technical schools to technical colleges. At the end of the 5-year course, students take the Advanced National Technical Certificate (ANTC) examination which replaces the City and Guilds of London Institute. Technical colleges in Nigeria train craftsmen in auto mechanics, plumbing, carpentry and joinery, cabinet making, painting, and decorating, welding, electrical installation, radio, and TV repairs, and building construction.

Vocational teachers or technical education teachers are engaged by the regulating bodies that take charge of the technical colleges to instruct students in the practical aspects of their career skills at middle, secondary, or post-secondary levels in the public and private educational institutions. The vocational teachers train individuals for vocations and technologies that are envisaged to enable a country to enjoy the fruits of technology and contribute to the overall technological development in the world (Onyeizu & Inedu 2020). In today's world, the skills of teachers are a vital component of society and its efforts to upgrade the students' learning achievements. The adoption of information and communication technologies by these educators will play a significant role in the effective delivery of educational instructions. They could

utilize these technologies in the classrooms to help facilitate the inculcation of complex skill sets to students (Latchem2017). Jawarneh et al (2007) examined vocational education teachers' adoption of information and communications technology in the Jordanian Secondary Vocational Schools, and they revealed that vocational schools remain vital places where future employees could be nurtured to acquire the required characteristics to meet today's workplace demands. He suggested that vocational teachers should be imbued with adequate physical resources to incorporate emerging ICT in their teaching. Up-to-date physical resources such as hardware and subject-specific instructional software in addition to internet connectivity should be made available for vocational teachers and their students.

A study by Kim (2020) was aimed to construct a conceptual model of teachers' effective practice of ICT-based instruction under a mandatory context in the Philippines using the Unified Theory of Acceptance and Use of Technology (UTAUT) model. Through a survey of 305 secondary school teachers, he found that performance expectancy (PE), effort expectancy (EE), social influence, (SI), and education policy (EP) have significant effects on the behavioural intention of teachers' to use ICTs and that ICT use of teachers and facilitating conditions (FCs) have positive effects on the actual use of ICTs for facilitating instruction.

Earlier, Radovan and Kristl (2017) examined the impact of the UTAUT structural model in addition to the Community of Inquiry (CoI) framework as a complement to teachers' use of ICTs for teaching and learning. They found that the use of learning management systems (LMS) was the major factor predicting the acceptance of a learning management system. These results conform to other studies that have shown that the increase in the perceived usefulness would often lead to a greater intention of people to use learning technology (Pynoo et al 2011).

It has also been revealed that ease of use (EE) is not a major determinant of intention to use an e-learning environment (BI) (Wang and Wang, 2009). This observation contradicts the findings of Gupta et al (2008) and Venkatesh et al. (2003), who found that there exists a positive impact of EE on BI. He further found that the results were more consistent with Gruzd, Staves, and Wilk (2012) and Pynoo et al. (2011), which reported a negative impact of EE on BI. He further revealed that Social Influence directly influenced the acceptance of the use of LMS, and that no direct influence exists with actual use. This is in agreement with Venkatesh's theoretical model (2003) and also confirms other empirical studies. Further studies revealed that facilitating conditions was an influential factor in accepting the LMS (BI), but the original theoretical model of UTAUT did not anticipate this result (Venkatesh et al 2003).

In the study of Attuquayefio and Addo (2014), it was found that effort expectancy, performance expectancy, and social influence positively influenced the behavioural intentions of students to use ICT for learning and that while facilitating conditions and behavioural intention also directly influenced much of students' usage behaviour of ICTs that were provided for learning and research. Also, they found that only effort expectancy and facilitating conditions significantly predicted students' intention to use ICT, and students' ICT use behaviour. Another study carried out by David and Rahim (2012) upheld the fact that the intention to accept and use ICT by the academic staff is determined by many concepts, including the understanding of the usefulness of ICTs in that education.

Nur's et al (2017) study was based on UTAUT variables of performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC), with behavioural intention and use behaviour as dependent variables. They showed a strong relationship between the behaviour of e-learning users and their performance expectancy affected their behavioural intention and behavioural intention. Rais and Muqorobin (2020) evaluated information systems using UTAUT and revealed that the performance expectancy, of effort expectancy, social influence, system service, and information quality have various degrees of influence on behavioural intention, but that only social influence and system service variables significantly and partially affected the behavioural intention.

6 Theoretical framework

The Unified Theory of Acceptance and Use of Technology (UTAUT), a model of acceptance of technology by Venkatesh et al (2003) guided this study. The UTAUT model consists of four core variables: performance expectancy, effort expectancy, social influence, and facilitating conditions – and four moderating variables – gender, age, experience, and voluntariness of use. Williams et al (2015) have suggested that the strength of UTAUT is because it was developed through the review and integration of eight dominant theories and models of technology use, namely: the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model, the Theory of Planned Behaviour (TPB), a combined TBP/TAM, the Model of PC Utilization, Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT). These theories and models have all been widely and successfully utilised by a large number of previous studies of technology or innovation adoption and diffusion within a range of disciplines including information systems, marketing, social psychology, and management.

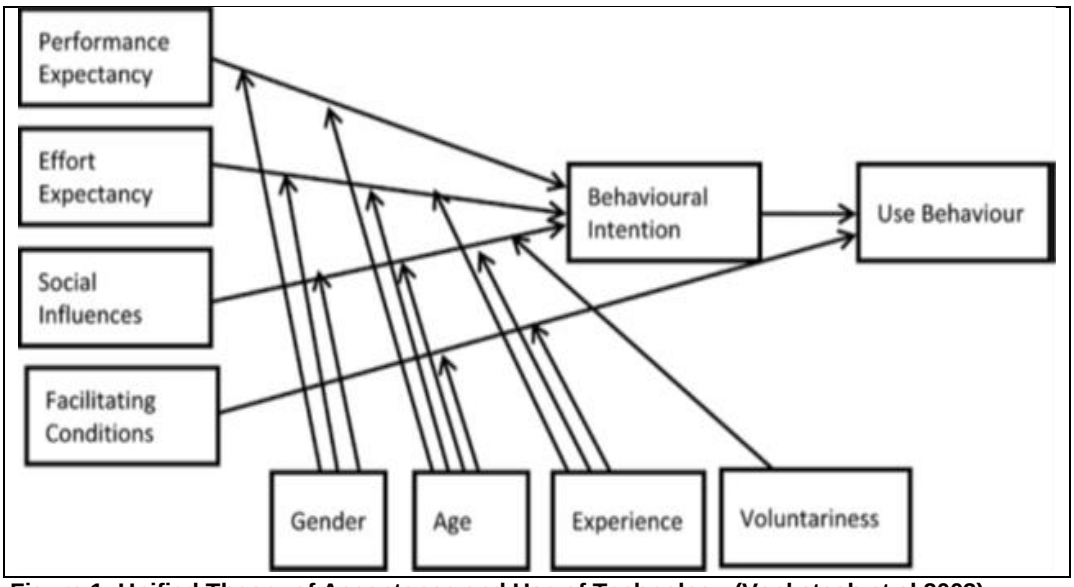

Figure 1: Unified Theory of Acceptance and Use of Technology (Venkatesh et al 2003)

The UTAUT (Figure 1) suggests that there are four core constructs that determine the human behavioural intention and ultimate behaviour towards technology, and that these constructs are, in turn, moderated by "… gender, age, experience, and voluntariness of use" (Venkatesh et al., 2003, 12). It could be argued that the presence of each of these constructs, and their performance in a real-world environment, will enable practitioners and researchers to evaluate human intention to use specific technologies or systems. This way, the identification of the key factors, and the extent to which they influence the acceptance and use of the technologies in any given context can be facilitated (Williams et al 2015). We now explain briefly each of the four constructs in UTAUT, as well as self-efficacy, computer efficacy and availability and accessibility, variables that have been established to influence information technology use.

Performance expectancy can be defined as "… the degree to which an individual believes that using a particular system/technology will improve his or her performance at work (Alfonso et al 2012, p8). Effort expectancy, on its own part refers"… to the degree to which a person believes that the use of a system or technology will be free of effort." (Alfonso et al 2012, p8). Facilitating conditions is the degree to which organizational and technical infrastructure are considered sufficient to support the use of a given technology. Finally, computer self-efficacy is often used in reference to the beliefs of an individual on his or her ability to deploy computers and to solve tasks and to manage situations. Finally, self-efficacy refers to one's belief in his or her competence to achieve specific tasks (Bandura 2006).

Further according to Bandura (2006), the focus on self-efficacy is not actually on the skills, but rather on the judgments that one expresses concerning what they can do with the skills they possess. Computer self-efficacy has an impact on an individual's prospects towards the use of computers to solve problems (Compeau & Higgins 1995). Individuals that do not see themselves as competent in the use of the computer will also tend not to be avid users of computers (Oliver and Shapiro 1993).

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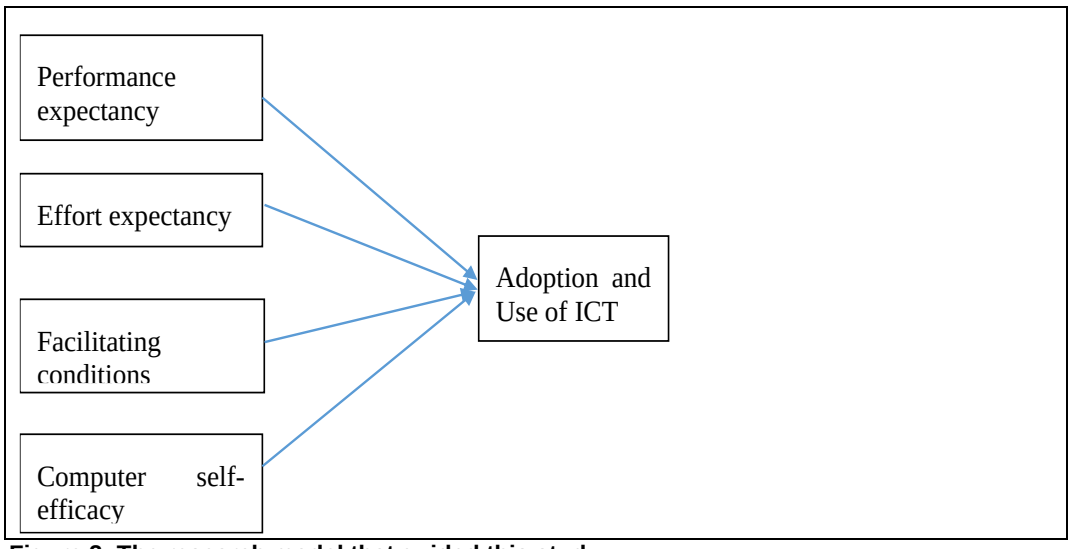

Figure 2: The research model that guided this study.

In figure 2, this study examines how performance expectancy, effort expectancy, facilitating conditions, computer self-efficacy, and availability of ICT explain the adoption and use of ICT in the technical colleges in Lagos Nigeria. We deliberately left out the demographic characteristics as contextual variables because an earlier diagnosis showed that none of the demographic variables contributed to the explanation of adoption and use of ICT, and the analytical method did not consider interaction.

Besides this research model, there are other concepts that are germane to use of information and communication technologies by teachers in vocational and technical education colleges. The concepts of availability and accessibility are very crucial in understanding the use of ICT by VTE teachers. Accessibility is the extent to which any user, irrespective of technical knowhow, can obtain resources and information where it is located in a system from anywhere and at any time (Penchansky & Thomas 1981). Availability is the quality of being able to be used or obtained; in this context it refers to whether or not the ICT tools are in place for use. Availability and accessibility are external factors, but there is evidence that they influence the adoption and use of ICT (Francis, Ngugi, and Kinz 2017).

7 Methodology

This study adopted a sample survey design. The study population was 430 vocational and technical education teachers in Lagos State Nigeria, according to the Lagos State Vocational and Technical Board website. The five colleges were located at Ade-soba, Ikotun, Agidingbi, Ikorodu, and Epe areas of Lagos State, Nigeria. With an error margin of 7%, a confidence level of 90%, and a z-score of 1.65, a sample of 105 was determined.

Data was collected using a questionnaire that consisted of 4 sections, each of which contained relevant items about the variables measured; the questions were all close-ended. The first section guided collection of data on demographic characteristics of the respondents: gender, age, and level of education. The second part included 7 items about the knowledge and experience of the participants on ICT. There were 24 items on UTAUT. However, the UTAUT variables considered were performance expectancy, facilitating conditions, effort expectancy, and computer self-efficacy. Items for performance expectancy and effort expectancy were adapted from (Adeoye & Olanrewaju 2019, Alshehri 2012). Items for facilitating conditions were adapted from (Al Zebidi 2016) while items for computer self-efficacy were adapted from (Marakas, Johnson & Clay 2007). The 5-point Likert-type scale was used to indicate the level of agreement to the following: “5” = Strongly Agree (SA) “4” = Agree (A) “3” = Neutral (N) “2” = Disagree (D) “1” = Strongly Disagree (SD). Contextual variables accessibility and availability of ICT were introduced by the researcher. Items for the contextual variable were developed from Nyakowa (2014).The fourth section contained 15 items to determine availability and access to ICT facilities.

The researcher sought permission from the principals of the institutions before proceeding to administer the questionnaire to the respondents. The study and the contents of the questionnaire were explained to the teachers in their staffrooms. The key reaction from the teachers was regarding whether the project was funded by an agency and whether the teachers would benefit from their participation in the study. Other questions were related to whether the project would be shared with a government agency in charge of technical education to attempt an implementation. The teachers were informed that the research was an academic exercise and not an intervention study. Therefore, the major benefit would that of contributing to knowledge about ICT and technical and vocational education in Nigeria. The output could also be an inspiration for an intervention in the future.

The total of 105 copies of the questionnaire were distributed to those teachers that were available in the school during data collection and were willing to complete the instrument. This implies that the study cases were selected using accidental sampling. The exercise lasted for about three weeks. A total of 90 (85.7%) of the questionnaire copies were returned out of which 18 (20%) were not usable because they contained missing responses. The remaining 72 (68.5%) were analyzed as a rate of 50% is usually acceptable in unsolicited surveys.

8 Data preparation and analysis

The reliability of the scales for the study was tested using the Cronbach Alpha approach. Table 1 indicates that the scales were not reliable in all the key adoption variables, but better reliability values were established for computer self-efficacy (0.80) and facilitating conditions (0.65).

Table 1: Variables in the study and their PCA loadings

Codes	Constructs	Cronbach Alpha	Mean	SD	Loadings
PE1	Using Information technology enables me to teach effectively		4.28	0.676	0.759
PE2	Using Information technology services will improve my job performance		4.13	0.668	0.617
PE3	Using information technology enables me to teach efficiently		4.26	0.731	0.793
PE4	Using information technology helps me utilize my time during class		4.03	0.903	0.392
PE5	Using information technology will improve my productivity	0.02	4.44	0.625	0.640
PE6	Using information technology enable me to accomplish the task quickly		4.96	0.744	0.599
PE7	My job will be difficult to perform without Information technology		3.58	1.110	0.461
EE1	Learning to use the computer system is easy		4.08	0.687	0.810
EE2	Using the computer system is easy		4.10	0.695	0.796
EE3	It is easy for me to become skillful at using educational software		4.74	0.895	0.265
EE4	By using an information technology system, I can get learners more engaged in the class.	0.17	4.80	0.797	0.469
EE5	Making use of ICT in the classroom is easy		3.81	0.898	0.641
FC1	I have the resources necessary to make research to use information technology services		3.60	1.146	0.588
FC2	I have knowledge necessary to use information technology services		4.07	0.793	0.661
FC3	There is a specific person or group available for assistance with any technical problem I may encounter	0.65	3.61	1.145	0.842
FC4	I have the necessary tools (mobile phone, laptop, etc.) to make research on any topic I intend to teach in class		4.19	0.944	0.707
CS1	I feel confident working on a personal computer		4.27	0.892	0.704
CS2	I make use of internet facilities to make research in preparation of my lesson note and plan		4.03	1.100	0.671
CS3	I make use of the computer to teach my students	0.80	3.35	1.365	0.745
CS4	I can confidently make use of educational software for teaching my students		4.10	0.842	0.660
CS5	I can install educational software in the computer system		3.84	1.057	0.726
CS6	I can use the computer to retrieve information		4.06	0.861	0.762
CS7	I can type and format documents using a computer		4.09	0.981	0.674
CS8	I give assignments online to my students		3.50	1.343	0.620

***PE=Performance expectancy, EE=Effort expectancy, FC= Facilitating conditions, CS=Computer self-efficacy**

Table 1 also shows the means and standard deviations of the variables in the study. On a scale of Strongly disagree=1 to Strongly agree=5, table 1 the mean rank of the responses shows that the majority of the respondents agreed with the assertions (Mean =4) in 20 of the 24 assertions. Only on four occasions did the teachers strongly agree (Mean =5) while on one occasion, the respondents were neutral (Mean=3.35) concerning I make use of the computer to teach my students. Table 1 also shows the PCA loadings for all the variables.

Given the relative homogeneity of the responses, dimensionality reduction for each of the four adoption variables was performed using Principal Component Analysis (PCA). Principal Component Analysis (PCA) is the most widely applied technique to reduce the number of dimensions of constructs in a construct, and by implication, the dimensionality of datasets. The outcome of the reduction exercise is a new dataset that have the same statistical variability that was in the original dataset. PCA usually identifies the components that are considered principal; they are usually fewer, but they

represent maximal variation existing in the original dataset. The new and fewer variables are linear functions of the variables in the original dataset. To meet statistical expectations, the new variables should be uncorrelated with one another.
To test whether a set of data is suitable for PCA, the Kaiser Meyer Olkin Test was used to confirm whether the items were the appropriate factors based on the variances. Bartlett's Test of Sphericity test is related to the validity and suitability of the responses supplied by the respondents to the questions that were addressed, and it does this by testing the significance of all the correlations existing in the correlation matrix. The BTS is measured using a Chi-Square test, and the null hypothesis is that the responses are not valid or is an identity matrix and must therefore be rejected. According to Hair, Black, Babin and Anderson (2010), the BTS test is measured from 0.000 to 1.0, while the overall KMO value should be at least 0.60. Table 2 relates to the tests of sampling adequacy and suitability of the responses.

Table 2: Table 2: KMO test of sampling adequacy and BTS

Test		PE	EE	FC	CSE
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)		0.593	0.625	0.583	0.722
Bartlett's Test of Sphericity (BTS)	Approx. Chi-Square	65.642	46.337	53.786	196.101
	Df	21	10	6	28
	Sig.	0.000	0.000	0.000	0.000

Table 1 contains the factor loadings for each of the variables. Table 2 confirms that the PCA performed well in all the constructs with KMO≥60, while the null hypothesis that the correlation matrix is an identity matrix, that is, (p=0.000) is rejected. Hence the extraction is valid.

8.1 Summary of the Extracted Variables using PCA

Table 3 shows that eight variables that explained the highest proportion of the total variances in each of the constructs were extracted. Performance expectancy had three variables extracted, effort expectancy had two variables extracted, facilitating conditions had one variable extracted and computer self-efficacy had two variables extracted.

Table 3: Summary of the extracted variables

Constructs	*Extracted variables*
Performance Expectancy	Using information and communication technologies enables me to teach efficiently, Using information and communication technology services will improve my job performance Using information and communication technologies will improve my productivity.
Effort Expectancy	Learning to use the computer system is easy It is easy for me to become skilful at using educational software
Facilitating Conditions	There is a specific person or group available for assistance with any technical problem I may encounter
Computer Self-Efficacy	I can use the computer to retrieve information I feel confident working on a personal computer

These extracted variables constituted the independent variables for further analysis. Given the assumption that PCA has isolated linear functions of the variables in the original dataset, multiple linear regression was considered adequate for testing the hypotheses. We carried out the investigation using the variables extracted for each construct.

9 Presentation of Results

9.1 Demographic characteristics of respondents

Out of the 72 respondents, 37 (51.4%) were males and 35(48.6%) were females (see table 4). The table also shows that 4.2% of the respondents were 20 years or below, and that 18.1% were 21-30 years, 33.3% were between 31-40 years old, 23.6% were between 41-50 years old while 20.8% were over 51 years old.

Table 4: Demographic characteristics of the respondents

Variables	Measures	Frequency	Percentage
Gender	Male	37	51.4
	Female	35	48.6
	Total	**72**	**100.0**
Age	20 or under	3	4.2
	21-30	13	18.1
	31-40	24	33.3
	41-50	17	23.6
	51 and above	15	20.8
	Total	**72**	**100.0**
Education Level	High School	3	4.2
	Diploma	13	18.1
	Bachelor's degree	30	41.7
	Postgraduate	26	36.1
	Total	**72**	**100.0**

Table 4 further shows that the majority of the vocational and technical teachers were between 31 and 50 years of age as they represented 56.9%, of which ages between 31 and 40 were the majority representing 33.3%. Table 4 also reveals that 41.7% had bachelor's degrees, 36.1% went further with their education to obtain post-graduate diplomas, and 18.1% had diplomas while 4.2% had high school certificates.

9.1 Use and Availability of ICT in technical colleges in Lagos State

Figure 3 shows that 86.1% of the respondents confirmed that ICT facilities are available in their schools, and the ICT facilities were in good working condition (66.7%).

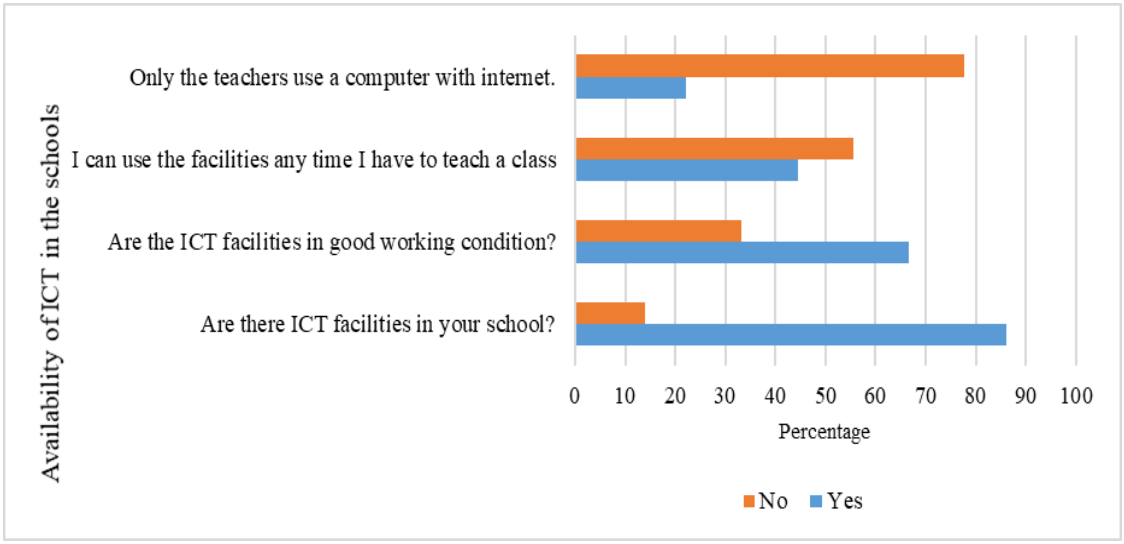

Figure 3: Use and availability of ICT in the schools

Further 44.4% stated they can use the facilities any time they have to teach a class while 22.2% reported that only school administrators use a computer with the internet (22.2%).

9.2 Accessibility of ICT

On the accessibility of ICT facilities, 36.1% reported that they have permanent access, 40.3% have access on-demand, and 23.6% have no access to a fully assembled desktop computer. Also, 30.6% stated that they have permanent access, 40.3% access on-demand, 29.2% have no access to internet services. Further, 20.5% stated that they have permanent access, 40.3% access on-demand, 34.7% had no access to computers with internet access. 29.2% stated that they had permanent access, 37.5% access on-demand, 33.3% had no access to a desktop computer without internet access. Also, 19.4% stated that they had permanent access, 47.2% had access on-demand, and 33.3% had no access to a non-internet-connected laptop, tablet PC, or notebook and computer.

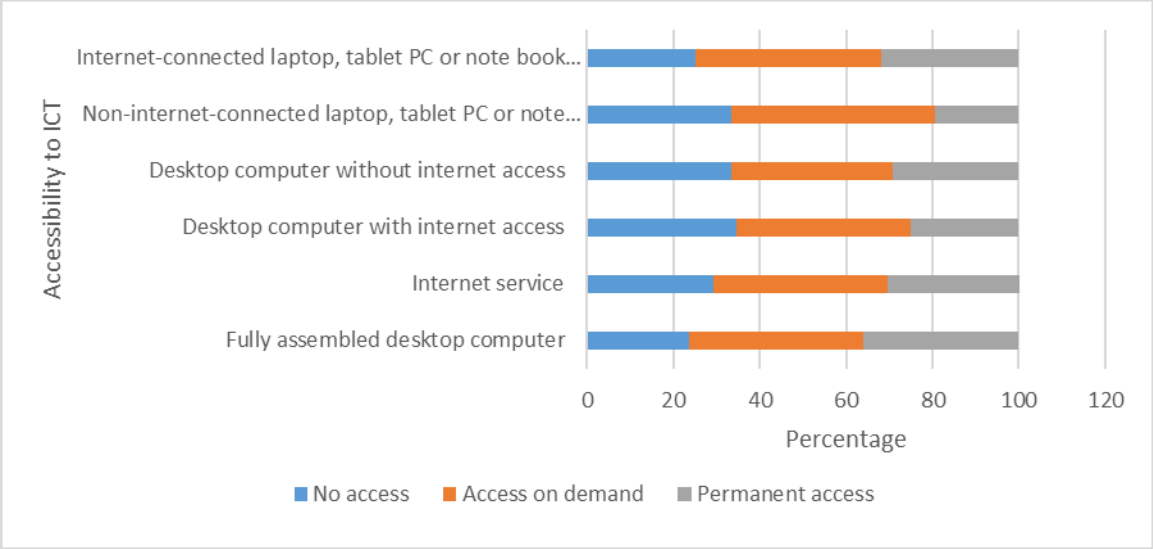

Figure 4 Accessibility to ICT

About 32% stated that they had permanent access, 43.1% accessed on-demand, and 25.0% had no access to Internet-connected laptops, tablet PC, or a notebook. Also, 33.3% stated that they had permanent access, 43.1% accessed on-demand, and 23.6% had no access to projectors. Furthermore, 50.0% and 56.9% stated that they had permanent access, 19.4% and 25% access on-demand, 30.6% and 18.1% had no access to interactive whiteboard and computer laboratory respectively.

9.3 Adoption and use of ICT

Table 5 shows that the majority of the respondents, 61.1% and 44.4% of the respondents reported that they had good knowledge of the computer and internet respectively; 23.6% and 40.3% had very good knowledge of the computer and internet respectively.

Table 5: Computer and Internet Knowledge

Variables	Measures	Frequency	Percentage
How do you describe your general computer knowledge?	Very poor	1	1.4
	Poor	3	4.2
	Moderate	7	9.7
	Good	44	61.1
	Very good	17	23.6
	Total	**72**	**100.0**
How would you describe your Internet knowledge?	Very poor	**-**	**-**
	Poor	5	6.9
	Moderate	6	8.3
	Good	32	44.4
	Very good	29	40.3
	Total	**72**	**100.0**

Small proportions, further 9.7 %, and 8.3% said that they had moderate knowledge of the computer and internet respectively while only 4.2 % reported that they have poor knowledge of the computer, and 1.4% had very poor knowledge of the computer.

On a scale of very poor (1) to very good (5), the majority of the teachers described their usage of ICT in the classroom to pass the instruction to learners as good (Mean=3.79, SD=1.02). On how long the teachers have been using ICT for teaching, the majority of the respondents 40.3%, have been using ICT for this purpose for the last 1-3 years; only 19.4% have been using it for more than three years while 13.9% have been using only in the last one year. The proportion of 19.4% that reported never using the technology for teaching could be considered high considering that the study is about vocational and technical education. On how often they used the computer to teach learners per week, 37.5% (Mean=2.20, SD1.13) reported using it for less than one hour, 22.2% reported 1-2 hours and 2-3 hours respectively while only 18.1% reported using the technology for more than three hours per week. In respect of how often they use the computer generally, 59.7% (Mean=1.63, SD=0.95) reported daily usage, 25% used weekly, 8.3% used twice weekly while 5.6% used monthly and other 1.4%.

9.4 Testing the hypotheses

The study tested the hypotheses using multiple linear regression for the UTAUT constructs of performance expectancy, effort expectancy and facilitating conditions, and computer self-efficacy.

Hypothesis One: There is no significant relationship between performance expectancy and the adoption of ICT by vocational teachers in the technical colleges in Lagos State, Nigeria.

The extracted variables from the performance expectancy construct contained three independent variables "Using Information Technology will improve my productivity, Using Information Technology services will improve my job performance", and, "Using Information Technology enables me to teach efficiently". For diagnosis, the multiple correlation coefficient value R, a measure of the quality of the prediction of the dependent variable, was 0.216 and indicates an acceptable level of prediction, though weak. The coefficient of determination R-Square (R2) which means that the amount of variance in the dependent variable that is explained by the independent variables was 0.47. This means that the independent variables or predictors explained 47% of the variation of adoption of ICT. Also, the model containing the predictors was statistically significant, F (3, 68) = 1.110, p<.05, meaning that the regression model is a good fit for the data. The F-ratio tested whether the overall regression model is a good fit for the data and is significant.

The regression results in Table 6 shows that B=-0.14, t=-0.257, p<0.000 for "Using information technology services will improve my job performance". The slope is not only small, but it is also negative, implying that using information technology for its capacity to improve job performance may not be an encouragement for its adoption.

Table 6: Regression analysis of performance expectancy and the adoption of ICT

Model	Unstandardized Coefficients	Standardized Coefficients		T	Sig.
	B	Std. Error	Beta		
(Constant)	3.161	0.756		4.181	0.000
Using Information Technology services will improve my job performance	-0.014	0.016	-0.031	-0.257	0.008
Using Information Technology enables me to teach efficiently	0.248	0.139	0.228	1.786	0.019
Using Information Technology will improve my productivity	-0.041	0.162	-0.032	-0.253	0.038

Concerning whether using information technology enables teachers to teach efficiently, B=0.248, t=1.786, p<0.19. Again, the magnitude of the slope is very low, but in this case, it is positive and significant. By implication, therefore, it can be inferred that the adoption of ICT in the colleges is marginally explained by the capacity of information technology to improve their teaching efficiency. Finally, using information technology to improve productivity has a low and negative explanation for the adoption of information technology (B=-0.041, t=-0.253, p=0.038).

Hypothesis 2: There is no significant relationship between the availability of ICT tools and the adoption of ICT by the vocational teachers in the technical colleges in Lagos State, Nigeria.

The researcher conducted Pearson correlation analysis to test the relationship between the availability of ICT tools and the adoption of ICT. The result in table 7 revealed that r=0.392, p<0.001.

Table 7: Pearson correlation table for the availability of ICT

		Adoption of ICT	Availability
Adoption of ICT	Pearson Correlation	1	.392**
	Sig. (2-tailed)		.001
	N	72	72
Availability	Pearson Correlation	.392**	1
	Sig. (2-tailed)	.001	

**. Correlation is significant at the 0.05 level (2-tailed).

Although r is positive, but it is very weak. Hence the presence or availability of ICT in the colleges has a low likelihood of influencing its adoption for teaching and learning purposes; factors that would promote adoption of the ICT are beyond the availability of the technology in the school.

Hypothesis 3: There is no significant relationship between effort expectancy and adoption of ICT by vocational teachers in the technical colleges in Lagos State, Nigeria.

Multiple regression analysis was further conducted to predict the adoption of ICT and the variables extracted for the effort expectancy construct. The constructs contained two independent variables: “It is easy for me to become skilful at using educational software and “Learning to use the computer system is easy.” The measure of the quality of the prediction of the dependent variable was R= 0.022, and this indicates a weak outcome. The R2, the proportion of variance in the dependent variable explained by the independent variables was therefore 0.00%, which implies that the predictors could not explain the variability of internet knowledge. However, the model containing the predictors was statistically significant, F (2, 69) = .017, p<.05. Hence, the regression model is a good fit, all the same. Table 8 shows the result of the regression analysis. “Learning to use the computer system” is easy very marginally predicted internet knowledge (B=0.027, t=0.180, p=0.00).

Table 8: Regression analysis of effort expectancy and adoption of ICT

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	4.068	0.627		6.489	0.000
Learning to use the computer system is easy	0.027	0.151	0.022	0.180	0.858
It is easy for me to become skillful at using educational software	0.000	0.017	0.003	0.024	0.981

There is no significant relationship whatsoever between ease of skillfulness at using educational software and adoption of the ICT for teaching and learning (B=0.000, t=0.024, p=0.981).

Hypothesis 4: There is no significant relationship between facilitating conditions and the adoption of ICT by vocational teachers in technical colleges in Lagos State, Nigeria.

Further multiple regression analysis was conducted to predict the adoption of ICT and the facilitating conditions construct. The constructs had just one independent variable “There is a specific person or group available for assistance with any technical problem I may encounter”. R was 6.480, indicating a very weak prediction; R2 was 42%, which meant that the predictor could only explain the 42% of adoption of ICT. The model was statistically significant, F (1, 70) = 3.013, p=0.43, implying that the regression model was a good fit for the data.

Table 9: Regression analysis of facilitating conditions and adoption of ICT

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	4.217	0.340		12.394	0.000
There is a specific person or group available for assistance with any technical problem I may encounter	-3.010	0.090	-0.013	-0.113	0.009

The predictor “There is a specific person or group available for assistance with any technical problem I may encounter” showed a negative predictive relationship with the adoption of ICT (B=-3.101, t=0.113, p=0.009).

Hypothesis 5: There is no significant relationship between computer self-efficacy and the adoption of ICT by vocational teachers in the technical colleges in Lagos State, Nigeria.

Finally, multiple regression analysis was also conducted to predict the computer self-efficacy and adoption of ICT. The constructs contained two independent variables “I can use the computer to retrieve information” and “I feel confident working on a personal computer”. R was 0.69 indicated a level of prediction, though weak, R2 was 0.4761, which meant that the predictors explained about 48%of the variability of adoption of ICT. The model was statistically significant, F (2, 69) = 1.290, p=0.042 (see table 10).

Table 10: Regression coefficients for computer self-efficacy and the adoption of ICT

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	3.702	0.596		6.207	0.000
I can use the computer to retrieve information	9.068	0.127	0.203	1.603	0.013
I feel confident working on a personal computer	2.81	0.122	-0.084	-0.665	0.006

The predictor “I can use the computer to retrieve information” made a unique statistically significant contribution to the model (B=9.068, t=1.603, p-0.000). Also, “I feel confident working on a personal computer made a significant contribution (B=2.81, t=0.665, p=0.006).

10 Discussion of findings

This study focused on adoption and use of ICT by teachers in selected vocational and technical colleges in Lagos State. The findings of this study revealed that there was a significant relationship between performance expectancy and adoption of ICT. “Using Information Technology enables me to teach efficiently” had a positive predictive relationship with the dependent variable “How do you describe your general computer knowledge?” This finding is in line with Ayaz and Yanartas (2020) in their study that applied the unified theory of acceptance and use of technology theory. The study also revealed that when ICT tools are readily available, they influence the teachers to adopt and use ICT to pass instructions to learners in the classroom as there was a significant relationship between the availability of ICT tools and adoption and use of ICT by vocational teachers. This finding corroborated with Ghavifekr (2016) while carrying out a study on use of ICT in teaching and learning. He found that the barriers are extrinsic to the teacher, that is, the barriers are external to teacher factors, and they include lack of resources, time, access, and technical support.

There was a significant relationship between effort expectancy (EE), and, adoption and use of ICT, as all the predictors of EE explained had positive relationships with the dependent variable. This finding is in line with Ayaz and Yanartas (2020) who stated “… it expresses the degree of convenience regarding the use of the system. The effort expectancy factor influences the behavioural intention in both voluntary and compulsory use environments.” It also corroborated with Almalki, (2011) and Wang and Wang (2009). Also, effort expectancy significantly predicted adoption because faculty members are willing to learn how to use ICT tools for educational purposes. There was no relationship between facilitating conditions and the dependent variable “There is a specific person or group available for assistance with any technical problem I may encounter” which showed a negative predictive relationship with the dependent variable “How would you describe your Internet knowledge?”

This was in contrast with most studies in the literature review of this study including Kim (2020) who revealed that facilitating conditions (FCs) have positive effects on the actual use of ICTs for instruction. Interestingly this finding was related to Thomas (2021) who carried out a study on determinants of adoption and use of e-learning for teaching technical and vocational skills in tertiary institutions in Rivers State Nigeria during the COVID-19 pandemic. The study revealed that the facilitating conditions of the institutions have a low but significant relationship with the adoption of e-learning for teaching in technical and vocational education programs in tertiary institutions in Rivers State, Nigeria. Lack of support from the administration and institution often results in the weakness of instructors in incorporating technology in the institutions. There is an unclearly stated institutional policy on ICTs use and e-learning in technical and vocational institutions which works against the adoption of e-learning in our tertiary institutions.

The result as shown in figure 4was in contrast with Momoh (2012) who observed that the government’s lack of commitment to technical education and inadequate funding has weakened technical education in Nigeria. This ICT may not be readily available in vocational training centres based on previous studies that technical colleges have not been given the right attention it deserves, irrespective of its role in nation-building and economic development. The result revealed that technical colleges in Lagos state are being given the attention needed hence ICT facilities are made available for learners and teachers to have better learning and teaching experience respectively.

predictor “I can use the computer to retrieve information” made a unique statistically significant contribution to the model recording an unstandardized coefficient value of 0.203 which showed a positive predictive relationship with the dependent variable “How would you describe your level of knowledge of the Internet?” There was a significant relationship between computer self-efficacy and the adoption and use of ICT. This finding was in line with Hong, et al. (2014) who revealed that the computer self-efficacy of teachers is directly proportional to the use of computers in the class for teaching and conducting research in Malaysian educational institutions. In other words, as computer self-efficacy increases the integration of technology in teaching and research also increases.

11 Conclusion

There exist ICTs in the colleges, and they were reported to be in relatively good working conditions, but less number of the teachers have the skill to use the technologies to teach in the class. A much lesser number reported that access to the ICTs in the schools is given to everyone. Teachers access their computer and internet as good. Efficiency in teaching, improvement in job performance, improvement in productivity were the performance expectancy factors in the adoption and use of ICT by the teachers in the vocational and technical colleges. The ease of learning how to use computers and the ease of acquiring skills in use of computers and software were effort expectancy matters that the teachers considered to be prime. With respect to facilitating conditions, the reference to technical assistance to solve problems was the most crucial item while retrieval of information and confidence using personal computers give the teachers are the major computer self-efficacy issues.

There is a significant relationship between performance expectancy the teachers had about ICTs and their adoption and use of ICT just as improvement of teacher performances, teacher efficiency and productivity also relate significantly with the adoption of the ICTs. However, these factors explain very small proportion of the variation, implying that performance expectancy, and, facilitating conditions, variables alone do not sufficiently explain adoption of the ICTs by the teachers. In the same way, the smallness of the correlation between availability of ICTs and their adoption suggest that just making ICTs available in the colleges would not guarantee their adoption. The teachers did not consider ICTs as resources that exert a lot of effort to acquire their usage and application. On the other hand, computer self-efficacy variables provide better explanation to the adoption and use of ICTs by the teachers, with non-fractional slopes, unlike the situation with the UTAUT key variables.

12 Further research

A major research need that emanates from this study is that UTAUT variables deployed in this study did not sufficiently explain adoption and use of ICTs for teaching by the teachers in the colleges. A more fruitful result might be obtained by undertaking a qualitative study through which unique and more specific variables could be generated, and then be used to explain the phenomenon. Another approach would be to deploy variants of technology use and adoption variables such as technology acceptance model, or others, to test the phenomenon. Furthermore, given the application of information and communication technologies in vocational and technical education, further studies are required to understand how students utilise the technologies, and how their use of these technologies could facilitate their technology learning achievements. Studies could also address the implementation of the national policies on vocational and technical education across the institutions in the country and examine the roles of the stakeholders and performance of the implementers. Finally, an examination of how mobile technologies serve as learning tools to the students is required to.

13 Limitations of the study

A better result would have been generated if multivariate analytical techniques such as MANOVA which considers and automatically computes interactions was used to determine the effects of the variables. This approach would also produce post hoc results which would decompose the outcome according to categories. Furthermore, this study was limited to a modification of UTAUT whereas there are several studies that used other models to identify a relationship between the adoption of ICT and the use of ICT by teachers. Furthermore, mobile phones are everyday company of people including students, but their use was not included in the present study. Finally, the strategy of vocation and technical education is a national one, and a wider scope study would be required to generate results that would address the subject matter from national perspective.

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