

Technological Indices Influencing Adoption Of E-Learning By Technical And Vocational Education And Training Institutions

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Abstract: Institutions of higher learning are increasingly turning to e-learning; however, Technical, Industrial, Vocational and Entrepreneurship Training institutions have not fully adopted e-learning despite this paradigm shift. This study set to achieve two objectives: to investigate the ICT infrastructure indices influencing adoption of e-learning by TIVETS and to determine the technical indices influencing adoption of e-learning by TIVETS. A sample of 385 respondents who were key informants were purposefully picked from five institutions. Questionnaires formulated in line with research objectives were used to collect primary data which were analyzed using Statistical package for social sciences (SPSS). The various technological indices were presented including the recommendations.

Keywords: technological, e-learning, adoption

1.0 INTRODUCTION

1.1 Background to the study

Higher education and training institutions around the world are increasingly turning to e-learning as a way of dealing with growing and changing student populations. They are looking to e-learning to provide convenient and flexible access to high quality education and training that is needed to meet these emerging demands. As they implement e-learning, however, institutions are struggling with the many pedagogical, organizational and technological issues (Bullen & Janes, 2007; Hussein, 2012). E-learning is an ideal learning environment through the effective adoption of modern Information Technology (IT) and the curriculum to achieve a new learning style which can fully reflect the main role of the students to thoroughly reform the traditional teaching structure and the essence of education, to train large numbers of high quality personnel (Ma, Wang, & Liang, 2008). In this context, traditional learning institutions have no choice but to significantly alter their instructional methods to keep pace with developments spurred by the Internet. Thus, adopting and adapting to the technology of the 21st century is unavoidable for everyone in society and in particular in the educational context (Ali, 2003; Collis & Moonen, 2005). E-learning is part of the new dynamic that characterizes educational systems at the start of the 21st century. Like society, the concept of e-learning is subject to constant change. The use of information and communication technologies (ICT) for educational purposes has increased, and the spread of network technologies has caused e-learning practices to evolve significantly (Sangrà, Vlachopoulos and Cabrera, 2012). The major driving forces behind this trend are the changing demographic factors of the students, changing conditions for education delivery and the innovation in technology itself. In order to keep pace with the changing trends, educational systems all around the world are in the process of integrating ICTs to enhance the learning experience of students. (Qureshi, Ilyas, Yasmin and Whitty, 2012).

1.2 Statement of the Problem

Despite the numerous e-learning initiatives to respond to the current challenges of TIVETS including the growing demand for higher education, the desired outcomes have

not been achieved. Studies have indicated that TIVETS are not effectively adopting and using ICT to support learning and management as intended. This is mainly because of the many challenges related to adoption and implementation mainly technological ((Manduku, Kosgey, and Sang, 2012; Tarus, 2011).

1.3 Research Objectives

The main objective of this study is to determine the technological indices influencing adoption of e-learning by technical and vocational education and training institutions. The specific objectives are:

- i. To investigate the ICT infrastructure indices influencing adoption of e-learning by TIVETS
- ii. To determine the technical indices influencing adoption of e-learning by TIVETS

1.4 Research Questions

This study seeks to answer the following research questions;

- i. To investigate the ICT infrastructure indices influencing adoption of e-learning by TIVETS
- ii. To determine the technical indices influencing adoption of e-learning by TIVETS

1.5 Significance of the study

The results of this study will make significant contribution to the effective development of technical and vocational education through knowledge of the technological factors affecting adoption of e-learning. The results of the study will also serve as useful guide in the provision of equipment and facilities for technical and vocational schools. The findings of this study will be useful governments and governing bodies by providing information on the specific technological issues that need to be addressed in the effort to improve access to education through e-learning.

The findings and recommendations of this study will provide an insight and add to academic body of knowledge in regards to technological factors and their effect on their adoption to e-learning.

2.0 LITERATURE REVIEW

2.1 Introduction

Qureshi, et al., (2012) indicated that the discussion of the definition and practices of e-learning focuses on the intersection of education, teaching, and learning with ICT; as such there are many definitions of e-learning conditioned by particular professional approaches (such as education, computer science, and communications technology) and, by particular individual or corporate interests. For this study the researcher will adopt the definition by Sangra, et al., (2012); as an approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways (evolution of technology) of understanding and developing learning (Sangra, et al., 2012).

2.2 E-learning Overview

Alonso, Lopez, Manrique and Vines (2005) conceptualized e-learning as the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services, as well as remote exchange and collaboration. E-learning is a broad combination of processes, content, and infrastructure to use computers and networks to scale and/or improve one or more significant parts of a learning value chain, including management and delivery (Aldrich, 2005). Gonzalez-Videgaray (2007) note that e-learning as learning based on information and communication technologies with pedagogical interaction between students and the content, students and the instructors or among students through the web. To further stress the influence of technology on e-learning, Ellis, Ginns and Piggott (2009) viewed it as information and communication technologies used to support students to improve their learning. Additionally, Jereb and Smitek (2006), regard e-learning as an educational processes that utilize information and communications technology to mediate synchronous as well as asynchronous learning and teaching activities.

2.3 Theoretical Review

Engelbrecht (2003) states that e-learning models began as mere replication of classroom instruction, but have evolved to those that integrate technology and pedagogy. Technology acceptance model (TAM) and Diffusion innovation theory will form the backdrop of this study.

2.3.1 Technology Acceptance Model

Technology acceptance model (TAM) was developed by Davis in 1989 to explain the determinants of user acceptance of a wide range of IT (Chen, Gillenson, & Sherrell, 2004). According to TAM, use of new IT is the product of a rational analysis of its desirable perceived

outcome, namely Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Davis defined PU as the degree to which a person believes that using a particular system would enhance his or her job performance. He also defined PEOU as the degree to which a person believes that using a particular system would be free of effort (Huang, 2005). TAM assumes that perceived use and perceived ease of use of IT forms individuals' belief on IT and therefore, predict their attitude toward IT, which in turn predicts acceptance of IT (Ma & Liu, 2004). TAM is the most researched and widely used theory among several models in the IS literature to explain individuals' acceptance of IT (Raaij & Schepers, 2006). According to Ma and Liu (2004), among the models used to explain acceptance of IT, the TAM is widely applied and empirically tested. There have been tens of empirical studies conducted on TAM since its inception. According to Lee, Kozar, and Larsen (2004), although prolific stream of research on use of IT uses a variety of theoretical models, of all theories, the TAM is considered the most influential and commonly employed theory for explaining individuals' use of IT.

2.3.2 Diffusion of Innovation Theory

Diffusion of Innovation Theory was developed by Rogers in 1995. He hypothesized that there are five fundamental characteristics of a new IT that promote degree and rate of its use (Schwarz, Junglas, Krotov, & Chin, 2004). Those characteristics are: (a) relative advantage of the new system over its predecessor; (b) complexity or ease of use of the new system; (c) compatibility or consistency with individual's existing values, past experiences, needs, and work patterns; (d) trialability or testability before commitment to use the new system; (e) observability so that potential user can observe the new system before use. Relative advantage is the degree to which an innovation is perceived as being better than the one it supersedes. Relative advantage is often expressed as profitability, social prestige, or other specified benefits in both individual and social contexts. Complexity is the degree to which an innovation is perceived as being difficult to understand and use. Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experience, and perceived goals of the user. Trialability is the degree to which an innovation may be experimented with, on a limited basis. Observability is the degree to which the results of an innovation are visible to others (Schwarz et al., 2004). According to Heilesen and Josephsen (2008), diffusion of innovation theory explains a process that involves not only logical reasoning, economic considerations and technical skills, but also, and perhaps decisively, the sentiments and frame of reference of the instructors, students and decision makers who are the end users. Therefore, the acceptance of e-learning systems can be understood in terms of the diffusion of innovation theory (Heilesen & Josephsen, 2008).

2.4 Conceptual Framework

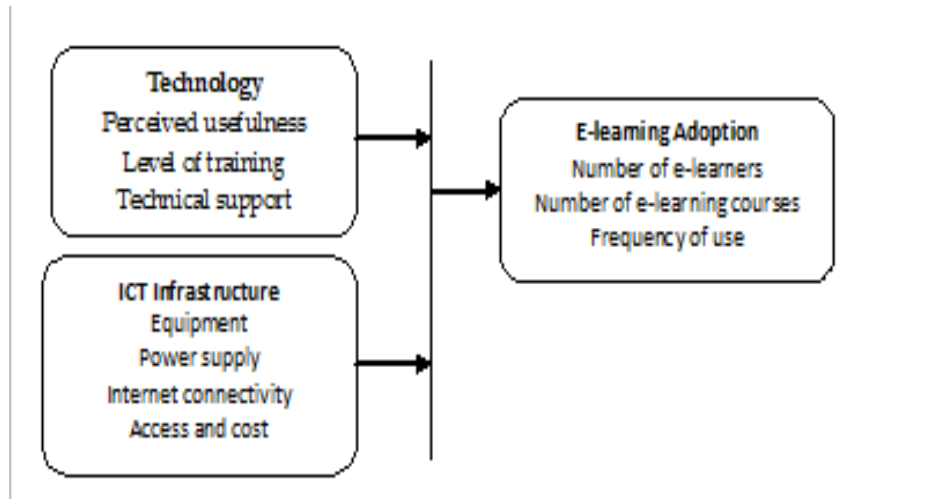


Figure 1: Conceptual Framework

Technology- To be successful in conducting learning activities, e-Learning is heavily influenced by various technologies and their successful implementation. There exists a profusion of technologies that enable the realization and expansion of e-Learning in terms of its course-content delivery (Chen et al., 2012). Here there are several factors under consideration: Perceived usefulness is an individual's perception that use of technology (in this case e-learning) will improve performance and has a large bearing on intention to use technology (Dörr, 2013). The elements under consideration are performance, effectiveness and productivity. The level of training stakeholders undergo with respect to will have a positive relationship with the adoption and implementation success. Training will go a long way in ensuring sufficient development of necessary know-how and skills for stakeholders. The selected training measures for the study are; training programs on the application; the clearance of training programs; users' role; availability of training material and support (Dörr, 2013). Technical support - The availability of technical support is one of the important factors in determining the acceptance of technology for teaching. This is especially the case in the beginning stage of technology adoption. Facilitating conditions and external control serve as anchors that users employ to inform perceived ease of use about information technology (Abbad et al., 2009). **ICT Infrastructure** - ICT infrastructure is a basic requirement for adoption of e-learning in learning institutions and indeed any organization. The concept of ICT infrastructure denotes all the facilities necessary for effective e-learning in schools. Such facilities include equipment, connectivity and sources of energy. Such infrastructure includes connectivity to various networks (internet, intranet); reliable sources of energy and backups (UPS, electricity, standby generators); equipment (computers, portable devices) and software, e-learning laboratories furniture and stores and information storage facilities (such as external hard drives, flash disks, CD-ROMs, DVDs) (Mulwa and Kyalo, 2011). According to Andersson and Gronlund (2009), the costs of using the technologies, how they are accessed and in what language they are available has a significant influence on e-learning adoption. Access to the technology is an enabling or disabling factor; the issue of access is often discussed in

terms of availability of e-learning centers, personal access (e.g. mobile access) and Internet cafés. Access refers not only to whether one has physical access to a computer and an Internet connection, but also to the reliability of the connection and the bandwidth, basically everything that is needed to access the full range of the content needed. The cost of these technologies refers to affordable and low-cost ICT alternatives and low user charges (Andersson and Gronlund, 2009). E-learning adoption success or failure will be determined by several indicators including; number of e-learners, number of e-learning courses, and frequency of use.

3.0 RESEARCH METHODOLOGY

This chapter covers the methods and procedures that used to achieve the set objectives of this study. Kothari (2004) observed that research design is a blue print which facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible hence yielding maximum information with minimal expenditure of effort, time and money. This study used survey research design which involves, asking participants questions on how they feel, what their views are, and what they have experienced (Babbie, 2002). Survey research design is useful when a researcher wants to collect data on phenomena that cannot be observed directly. The study was based on government approved public Technical, Industrial, Vocational and Entrepreneurship Training institutions in Kenya. For convenience of data collection five (5) TIVET institutions in Kenya were purposively chosen for the research. The institutions were: Kabete Technical Training Institute, Nairobi Technical Training Institute, Thika Technical Training Institute, Kiambu Institute of Science and Technology and Kinyanjui Technical Training Institute. Cochran formula for sample

determination was used:
$$n = \frac{Z^2 pq}{d^2}$$

Where:

n=the desired sample size

Z=the standard normal deviate at 95% confidence level

q=1-p

p = is the estimated proportion of an attribute that is present in the population
 q = is the estimated proportion that an attribute is not present in the population
 d = the level of statistical significance set

$$n = \frac{Z^2 pq}{d^2} = \frac{1.96^2 (0.5 \times 0.5)}{0.05^2} = 384$$

A sample of 385 respondents were obtained from the five selected TIVETs.

Table 1: Sampling

TIVET	Sample			
	Students	Teachers	Administrators	Total
Kabete Technical Training Institute	70	5	2	77
Nairobi Technical Training Institute	70	5	2	77
Thika Technical Training Institute	70	5	2	77
Kiambu Institute of Science and Technology	70	5	2	77
Kinyanjui Technical Training Institute	70	5	2	77
Total	350	25	10	385

A semi-structured questionnaire was used for data collection. Data was collected using drop and pick method. Content analysis and descriptive statistics including mean scores, standard deviation and factor analysis were used to analyze the data. The data collected was analyzed and presented using mean scores, standard deviation and Factor analysis. Factor analysis was used to compress the

data and reduce mass data into condensed and more comprehensible format; to uncover the basic structure in data analysis. Frequency distribution tables, pie charts and histograms were used where appropriate so as to ensure that the research is clear and easily understandable. IBM SPSS Statistics version 22 was used for data analysis.

4.0 DATA ANALYSIS AND PRESENTATION

4.1 General Information

The research sample was evenly distributed from five colleges namely Kiambu Institute of Science and Technology, PC Kinyanjui, Kabete, Nairobi Technical Training Institute, and Thika Technical Training Institute.

Table 2: Response rate

	Target sample	Responses	Rate (%)
Students	350	318	90.6
Teachers	25	24	96
Administrators	10	9	90
Total	385	351	86.2

Table 2 indicates the response rate of the study, with that of the students being 90.6%, teachers 96%, and administrators 90%. The overall response rate was 91.2%. The researcher sought to find out the environment in which the respondents engaged in learning or teaching. The findings are indicated in Figure 2.

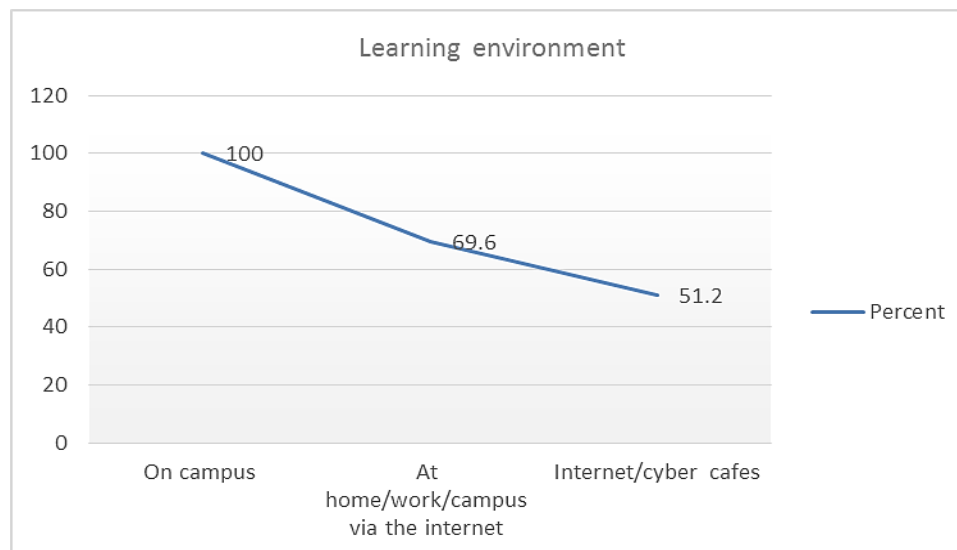


Figure 2: Respondents learning/teaching environment

According to the survey, all the learning and teaching in TIVETs occurred on campus, however 69.6% of the respondents learning environment was at home/work/campus via the internet or in internet/cyber cafes according to 51.2% of the respondents. This indicates that as much as the TIVETs are class centric with most of

the interactions being face to face technology has been addressed to some extent to supplement classroom learning interactions. In regards to availability of e-learning management system in the institutions, the response is as indicated in Table 3

Table 3: Availability of e-learning management system

	Frequency	Percent	Cumulative Percent
No	274	78.1	78.1
Not sure	77	21.9	100
Total	351	100	

According to majority of the respondents (78.1%) their institutions did not have any operational e-learning nor offer any course through e-learning; 21.9% of them were unsure about this.

4.2 ICT Infrastructure Indices Affecting Adoption of E-learning by TIVETs

The researcher sought to determine ICT infrastructure indices that affect e-learning adoption, the findings are indicated in Table 4.

Table 4: ICT Infrastructure Indices

ICT Infrastructure Indices	Mean	Std. Deviation	Analysis N
<i>Connectivity</i>			
Internet connectivity	4.4217	0.6520	100
3G mobile network coverage	3.9334	0.4159	100
Intranet connectivity	2.8238	1.6154	100
<i>Equipment</i>			
Computers	4.1689	0.4357	100
Portable devices	3.7935	0.9249	100
Software	4.0165	0.5348	100
<i>Sources of power/energy</i>			
Electricity supply	4.4831	0.3594	100
Standby generators	1.1267	0.5108	100
Uninterruptable power supply	2.0721	1.1561	100

The research findings showed that majority of the respondents were of the opinion that electricity supply, internet connectivity, access to computers and software impacted e-learning adoption extensively as indicated by their means of 4.4831, 4.4217, 4.1689 and 4.0165 respectively. Additionally, standby generators and uninterruptable power supply impacted adoption to a small extent as shown by their means of 1.1267 and 2.0721

respectively. The lowest standard deviation was reported in electricity supply implying that most respondents shared similar opinion that electricity supply significantly affects e-learning adoption. The highest standard deviation of 1.6154 was found in intranet connectivity meaning that most respondents had varied opinion on to what extent intranet connectivity affected e-learning adoption.

4.3 Technological Indices Affecting Adoption of E-learning by TIVETs in Kenya

The technological indices that affect e-learning are as established by the study are indicated in Table 5.

Table 5: Technological Indices

Technological Indices	Mean	S.D.
The perceived usefulness of e-learning on learning/teaching/management performance, and productivity influences its adoption	4.6412	0.3503
Training and development programs should be offered periodically to ensure successful adoption and use of e-learning	4.4436	0.9851
Sufficient and timely technical support both for the e-learning and ICT infrastructure is an important adoption factor	4.1741	0.5183

Majority of the respondents strongly agreed that perceived usefulness of e-learning on learning/teaching/management on performance, and productivity influences its adoption. Similarly they also agreed that training and development programs should be offered periodically to ensure successful adoption and use of e-learning and that sufficient and timely technical support both for the e-learning and ICT infrastructure is an important adoption factor as indicated by means of 4.4436 and 4.1741 respectively. Perceived usefulness had the lowest standard deviation indicating that most respondents shared similar opinion on its impact on adoption.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Findings

This study conducted in selected TIVET institutions was aimed at determining the technological indices that affect the adoption of e-learning by TIVETs.

5.1.1 ICT Infrastructure Indices

ICT infrastructure is a basic requirement for adoption of e-learning in learning institutions and indeed any organization; these were categorized into Connectivity, equipment and sources of power. The study found out that here, electricity supply was the most significant factor influencing e-learning adoption in TIVETs. This could be attributed to the fact that to e-learning requires devices that have to be powered. Additionally, internet connectivity, availability of computers and the requisite software were found to be significant. This sounds logical considering that these are necessities for e-learning access. Notably, alternative sources of power supply and intranet were not considered as important indices in determining e-learning adoption.

5.1.2 Technological Indices

Perceived usefulness of e-learning adoption on learning, teaching, management's performance and productivity was

found to be the most influential technological index for e-learning adoption. The availability of periodical training and development programs for e-learning stakeholders and availing of training material was also found by the study to be significant. Similarly, though not to as much extent as the previous indices, the availability of sufficient and timely technical support both for the e-learning and ICT infrastructure is an important element in determining e-learning adoption in TIVETs.

5.2 Recommendations

With greater focus in higher education on student-centered teaching and learning practices. E-learning continues to develop with emerging technologies, bringing more opportunities for both the students and faculty staff members. However, e-learning requires considerable support not only from infrastructural and logistic perspectives, but also from a pedagogical and content perspectives, where technology is expected to be effectively integrated across the vast activities and teaching and learning transactions within TIVETs through a holistic and well planned approach. TIVETs should endeavor to establish ICT centers and provide necessary facilities like computers, web-connectivity and constant electricity supply in the institutions to enhance students' access to e-learning facilities. TIVETs should think of alternative sources of energy supply like solar energy to help augment the perennial power supply interruptions. Awareness and sensitization programs on the technological trends impacting learning/teaching and their importance should also be conducted by relevant authorities to encourage adoption. Students should be assisted by TIVETs and other organizations (governmental or otherwise) and individuals to possess/access personal computers through subsidized rates or through loans and grants. Capacity building workshops in ICT should be organized for lecturers to enhance their ICT skills and increase their confidence level in the use of e-learning modes in service delivery. TIVETs should seek for external and internal assistance in the provision of e-learning facilities for students and teachers.

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