

TVET in Driving Sustainable Development: Strategies for Mitigating Challenges Associated with the Integration of ICT in Instruction of Engineering Subjects

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Abstract

Despite the investments on information and communication technology (ICT) infrastructure, equipment and professional development to improve education and training, integration of ICT into classroom learning still poses challenges to teachers, administrators and policy makers. And while the use of ICT creates a powerful teaching and learning environment its benefits of transforming learning and teaching where interaction of knowledge is active, self-directed and constructive, are yet to be fully enjoyed. The impact of rapid technological change and automation on existing skills has led to the identification of strategies for mitigating challenges associated with the integration of ICT in instruction of engineering subjects. Thus this study set out to establish the existing gaps in the strategies for mitigating challenges associated with the integration of ICT in instruction of engineering subjects. The output of this study was to serve as a blueprint for TVET institutions, ICT policy makers, researchers and other education institutions in Kenya to chart the right course of action for the integration of ICT through policy formulation and implementation in achieving the country's strategy of vision 2030 and sustainable development. This research adopted Technology Acceptance Model (TAM) since it is capable of explaining user behavior across a broad range of end-users of ICT. It utilized descriptive research design which allowed a large target population to be directly observed. It targeted 180 trainers/instructors and 12 administrators from the 12 TVET institutions. Purposive and simple random sampling was used to select 12 administrators and 138 trainers/instructors. Interview schedules and questionnaires were used to collect data and frequency and percentage data analysis were used to identify strategies for mitigating challenges associated with the integration of ICT in instruction of engineering subjects. The strategies for mitigating the said challenges associated with the integration of ICT in instruction of engineering subjects were thus established in this research study conducted in TVET institutions within Uasin Gishu County in Kenya. Based on the findings, the study concluded that there is need for the government to support TVET institutions on the strategies for mitigating challenges associated with the adoption and integration of ICT in instruction of engineering subjects.

Key words: *Strategies, ICT integration, Challenges, Instruction, Engineering Subjects*

Introduction

Integrating ICT into curricula with the intent of positively influencing teaching and learning has been in a state of evolution over the past 20 years (Dias & Atkinson, 2001). The use of ICT creates a powerful teaching and learning environment and it transforms the learning and teaching process in which students deal with knowledge in an active, self-directed and constructive way (Volman & Van Eck, 2001). A

number of previous studies have shown that an appropriate use of ICT can raise educational quality and relate learning to real-life situations. According to Flanagan and Jacobsen (2003), integration of ICT is meant to be cross-curricular rather than a separate course or topic in itself. Despite the investments on ICT infrastructure, equipment and professional development to improve education, integration of ICT into classroom practices poses a challenge to teachers, administrators and policy makers. Research conducted in many schools has established that most of them are not effectively adopting and using ICT to support learning, teaching and management as intended (Manduku, Kosgey, & Sang, 2012). Though, studies reiterating the advantages of ICT in education cannot be exhausted in the dynamic knowledge based society, the literature on the integration of ICT in instruction of engineering subjects is often not comparable to other fields of specializations and has attracted only few scholars' advocacy. This study emanated from concern for additional literature on the integration of ICT in instruction of engineering subjects and to further support the contributions (publications) in 'ICT by TVET professionals' around the globe.

The Main Purpose and Objectives of the Study

The purpose of this study was to identify strategies for mitigating challenges associated with the integration of ICT in instruction of engineering subjects. It was hoped that the output of this study would serve as a blueprint for TVET institutions, ICT policy makers, researchers and other education institutions in Kenya to chart the right course of action for the integration of ICT through policy formulation and implementation in achieving the country's strategy of vision 2030. This study first highlighted the challenges associated with the adoption and integration of ICT in instruction of engineering subjects with the view of identifying strategies employed to overcome these challenges.

This research adopted Technology Acceptance Model (TAM) since it is capable of explaining user behavior across a broad range of end-users of ICT (Lee, Kwon & Schumann, 2005).

Literature Review

While ICT continues to advance in Western and Asian countries, African countries still experience a lag in its implementation, and that continues to widen the digital and knowledge divides. In a recent study by Kiptalam and Rodrigues (2010), observed that access to ICT facilities is a major challenge facing most African countries, with a ratio of one computer to 150 students against a ratio of 1:15 students in the developed countries. Whereas results indicate that ICT has penetrated many sectors including banking, transportation, communications, and medical services, the Kenyan educational system seems to lag behind in ICT.

Challenges Facing ICT in Education in Kenya

Among the challenges that affect the successful integration of ICT into instruction of engineering subjects are trainer's attitudes and beliefs towards technology (Hew & Brush, 2007; Keengwe & Onchwari, 2008). Tella, Toyobo, Adika, & Adeyika,

(2007) found that computer use was predicted by intentions to use and that perceived usefulness was also strongly linked to these intentions.

Report by the MoHEST (2012) indicated that ICT use in Kenyan classrooms is still in its early phases, and concluded that the perceptions and experiences of teachers and administrators do play an important role in the use of ICT in Kenyan classrooms. The demand for ICT skills has been tremendous and a number of teachers are not trained to teach ICT skills to meet the demand. There are more students who need to acquire ICT skills from the teachers who are competent to transfer the skills. ICT tools are still very expensive and despite spirited efforts by the government agencies, NGOs, corporate organizations and individuals to donate ICT tools to as many education institutions as possible, there still remain a big percentage of education institutions unable to purchase the same for learning purposes. Some education institutions are still not yet connected to electricity. Kenya being a developing country, the government has not been able to connect all parts of the country to the national electricity grid.

Consequently those education institutions that are found under such areas are left handicapped and may not be able to offer classroom instructions using ICT. While some numbers of education institutions have acquired ICT tools, they have not been adequately equipped with maintenance and repairs; hence it is very common to find these institutions with many broken ICT tools. The fact that ICT tools are valuable makes these tools a target for thieves who would easily have ready markets. This has made educational institutions to incur extra expenses trying to burglarproof rooms used for storing the ICT tools. Such situations have made some educational institutions to shy away from purchasing ICT tools.

There is also the challenge of teachers having the fear of being rendered irrelevant by the use of computers in his/her class due to the feeling that the teacher cherish to remain an authority and one who knows everything in class, and anything that makes them otherwise is deemed an enemy of the classroom. Another problem is that educational institutions are not able to connect to the World Wide Web (WWW) because of the high costs involved in the connectivity. The connection may also be on very low speed. There could also be lack of initiative by the community leaders in purchasing and installing ICT tools as a priority. The fear of increased moral degradation from internet pornography, cyber bullying, other anti-social behaviours are worrying emerging challenges (MoHEST, 2012).

The National ICT Policy (2016) is guide for Kenya that has put in place an ICT policy that aimed to improve the livelihoods of its citizens by ensuring the availability of accessible, efficient, reliable and affordable ICT services. The national policy addresses several sections, among them includes: Information technology, Broadcasting and Telecommunications. However, it is the section of information technology that sets out the objectives and strategies pertaining to ICT and education. The relevant objective in this section states that the government will encourage the use of ICT tools in educational institutions in the country so as to improve the quality of teaching and learning. ICT can play a significant role in equalizing opportunities for marginalized groups and communities. But the paradox is that for those groups that are unable to cross the technology divide, ICT is yet another means to further marginalize them. Adoption and integration of ICT in instruction has a major role to play in solving this problem. Thus, unless ICT

becomes part of instructional content, such problems will continue (National ICT Strategy for Education & Training, 2006).

Strategies Adopted to Mitigate the Challenges

Several factors can be identified that discourage the use of ICT; key to these factors are inadequate infrastructure and skills to integration of ICT (Albirini, 2006; Pelgrum, 2001). In fact, the integration of ICT is associated with several factors that hinder and enhance the use of ICT in instruction which might be termed as restraining forces and enabling forces (Yeboah, 2013). In order to increase the rate of ICT adoption, there is need to improve the enhancing factors and reduce the hindering factors to a minimal. The extent of this restraining force and enabling force determine the extent of ICT adoption and use. If the enabling forces are very high, it means the rate of ICT adoption and integration will be very high, and if the restraining forces are very high, it means that the rate of ICT adoption and integration will be very low. When these forces are kept at moderate level, ICT adoption and integration will be at optimum state. This model is represented in the Figure 1 below.

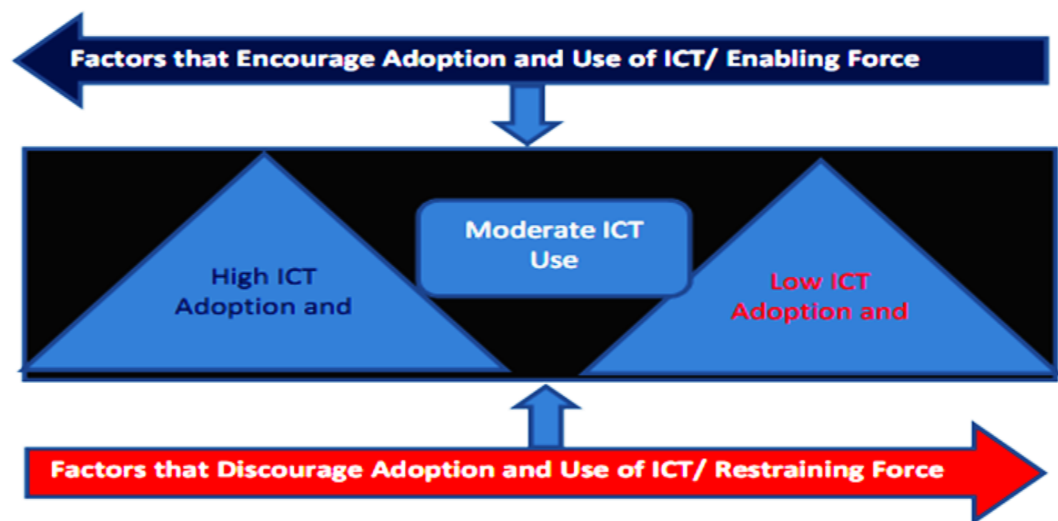


Figure 1. Model for increasing ICT adoption and integration from Yeboah (2013)

According to Anderson and Dexter (2005), leadership is one of the several critical strategies in the successful integration of ICT in education and training. Neyland (2011) in assessing the technology integration processes in Turkish education system reported that in providing TVET institutions with ICT hardware and software ICT, it is also crucial to provide them with technical support such as repair and maintenance. Becta (2004) found that professional development was one of the most important strategies in most education institutions for ICT integration into instruction.

Methodology

The descriptive research design was used in this study which was considered appropriate as it gave a detailed description of the strategies for mitigating

challenges associated with the integration of ICT in instruction of engineering subjects. It enabled the collection of data from various TVET institutions in Uasin Gishu County with large target population to be observed directly. The research target was 180 trainers/instructors and 12 administrators from the 12 TVET institutions and purposive sampling was used to select 12 administrators. Simple random sampling was used to select 138 trainers/instructors from a sampling frame of 147 returned questionnaires. Interview schedules were also used to collect data from the administrators. This helped to guard against distorting the questions, since the questions were clarified thereby helping the key informant (administrator) to give relevant responses. Frequency and percentage data analysis was used to identify strategies for mitigating challenges associated with the integration of ICT in instruction of engineering subjects. The technique was appropriate because the responses were interval and ratio-scaled.

Findings and Discussions

The respondents were requested to identify the strategies for mitigating challenges associated with the integration of ICT in instruction of engineering subjects. One hundred and twenty two (78.4%) generally agreed that providing ICT skilled trainers was a strategy to mitigate challenges in adoption and integration of ICT in instruction of engineering subjects, 6 (4.4%) disagreed and 10 (7.2%) were undecided. One hundred and twenty four (89.9%) generally agreed that providing ICT infrastructure, such as computer and other ICT tools was a strategy, 4 (2.9%) disagreed and 10 (7.2%) were undecided. One hundred and seventeen (83.8%) agreed that retraining of trainers on new ICT changes was a strategy, with five (3.6%) disagreeing and 16 (11.6%) being undecided. One hundred and thirteen (81.9%) agreed that all courses at TVET institutions to have course website was a strategy, and 9 (6.5%) disagreed and 16 (11.6%) undecided. A majority of 111 (80.4%) agreed that the availability of national and institutional ICT policy and implementation plan to monitor and evaluate ICT integration was a strategy, with 11 (7.9%) generally disagreed and 16 (11.6%) were undecided. The responses on providing library reserves for electronic ICT resources, for example software of instructional content/manual as a strategy, 119 (86.2%) generally agreed, while 9 (6.5%) disagreed and 10 (7.2%) were undecided.

Also, the majority of respondents 119 (86.2%) generally agreed on increasing speeds of internet connectivity as a strategy, while 3 (2.2%) disagreed and 16 (11.6%) were undecided. From the study one 112 (81.1%) of the respondents agreed on conducting mandatory technology courses such as management information systems for all trainers as a strategy, and 13 (9.4%) disagreed and 13 (9.4%) were undecided. One hundred and twenty two (88.4%) of the respondents generally agreed that providing technical support for use of ICT at the classroom level was a strategy with 1 (0.7%) strongly disagreeing and 15 (10.9%) undecided. One hundred and eleven (80.5%) of the respondents generally agreed that having better collaboration among trainers by using online discussion boards was a strategy, while 10 (7.3%) disagreed and 17 (12.3%) were undecided. One hundred and twenty two (88.4%) agreed that financial readiness of the institution to support ICT integration was a strategy, 2 (1.4%) disagreed and fourteen (10.1%) were undecided on the strategy. Finally, one hundred and thirteen (81.9%) of the respondents agreed that having collaboration/donation from community leaders

was a strategy was a strategy, with eight (5.8%) generally disagreeing and seventeen (12.3%) were undecided. These results are also presented in Table 1 below.

Table 1: Strategies for Mitigating Challenges Associated with Adoption and Integration of ICT in Instruction of Engineering Subjects

Strategy	Strongly Agree		Agree		Undecided		Disagree		Strongly Disagree	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Providing ICT skilled trainers	60	43.5	62	44.9	10	7.2	3	2.2	3	2.2
Providing ICT infrastructure e.g. computer and other ICT tools	57	41.3	67	48.6	10	7.2	4	2.9	-	-
Retraining of trainers on new ICT changes	54	39.1	63	45.7	16	11.6	3	2.2	2	1.4
All courses at TVET institutions to have course website	57	41.3	56	40.6	16	11.6	6	4.3	3	2.2
Availability of national and institutional ICT policy and implementation plan to monitor and evaluate ICT integration	57	41.3	54	39.1	16	11.6	10	7.2	1	0.7
Providing library reserves for electronic ICT resources e.g. software of instructional content/manual	73	52.9	46	33.3	10	7.2	6	4.3	3	2.2
Increasing speeds of internet connectivity	65	47.1	54	39.1	16	11.6	3	2.2	-	-
Conducting mandatory technology courses such as Management Information Systems for all trainers	58	42.0	54	39.1	13	9.4	6	4.3	7	5.1
Providing technical support for use of ICT at the classroom level	61	44.2	61	44.2	15	10.9	-	-	1	0.7
Having better collaboration among trainers by using online discussion boards	59	42.8	52	37.7	17	12.3	7	5.1	3	2.2
Financial readiness of the institution to support ICT integration	70	50.7	52	37.7	14	10.1	2	1.4	-	-
Having collaboration/donation from community leaders	43	31.2	70	50.7	17	12.3	3	2.2	5	3.6

The findings indicated that the strategies for mitigating challenges associated with the integration of ICT in instruction of engineering subjects included the following: Providing ICT skilled trainers; Providing ICT infrastructure such as computer and other ICT tools; Retraining of trainers on new ICT changes; All courses at TVET institutions to have course website; Availability of national and institutional ICT policy and implementation plan to monitor and evaluate ICT integration; Providing library reserves for electronic ICT resources e.g. software of instructional content/manual; Increasing speeds of internet connectivity; Conducting mandatory technology courses such as Management Information Systems for all trainers; Providing technical support for use of ICT at the classroom level; Having better collaboration among trainers by using online discussion boards; Financial readiness of the institution to support ICT integration; and Having collaboration/donation from community leaders. This concurs with MoHEST (2012) that ICT policy should lead to ingenuity and improved pedagogical practice among TVET institutions and advocates for innovative practices in the adoption and integration of ICT in instruction.

Conclusion and Recommendation

Based on the purpose of the study, it was concluded that the government should support TVET institutions to create the right environment that will encourage the adoption and integration of ICT in instruction. The study recommended that there is need for the government to support the strategies for mitigating challenges associated with the adoption and integration of ICT in instruction of engineering subjects.

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