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Abstract

The purpose of this study was to examine the relationship between the ICT applications and undergraduate students' critical thinking skills in e-learning in selected Universities in Kenya. The study applied the quantitative approach in data collection and analysis plus a descriptive correlational design. The sample was drawn from undergraduate students taking e-learning in their third and fourth year of study in four selected universities in Kenya. The researcher generated descriptive and inferential statistics using statistical package for social sciences (SPSS). The findings are presented using tables. The correlation results indicated that there was significant strong positive relationship between ICT applications and undergraduate students' critical thinking skills in e-learning ($r=0.582$; $p=0.05$). From the research literature, little is known on the relationship between ICT applications and Critical thinking skills. This current research contributes to knowledge in this area by suggesting that there is a strong positive relationship between ICT applications and undergraduate students' critical thinking skills in an African context. ICT applications of interactive and discursive nature such as WhatsApp, Microsoft Word, Microsoft Power point and discussion forums were found to associate with critical thinking skills in the context of this study.

Keywords: *ICT applications, undergraduate students, critical thinking skills, e-learning & Universities in Kenya.*

1.0 INTRODUCTION

1.1 Background of the Study

The use of Information Communication Technology (ICT) in education and training has been a priority in most countries during the last decade, but progress has been uneven (Pelgrum, 2004). In most developed countries such as UK, schools have embedded the use of ICT in teaching and learning into the curriculum and demonstrate high level of effective and appropriate use to support teaching and learning Organization for Economic Cooperation and Development, (OECD, 2004). The countries have integrated ICT into their education system because of its profound implications such as enabling teachers and students to construct rich multi-sensory, interactive environments with almost unlimited teaching and learning potential.

According to Unwin (2004), computers and internet can be used to increase teachers' basic skills and subject mastery, to provide resources that can later be used in classroom, and to help teachers build familiarity with specific instructional approaches.

The United Kingdom Aid (2012) carried out a study among staff in three African Universities namely, University of Zambia, Mzuzu University in Malawi, and University of Botswana on Building Research Capacity and Enabling Critical Thinking through Information Literacy in Higher Education in Africa. The researchers found that many graduates lack critical thinking even though there are initiatives towards that end. The identified precipitating factors included but not limited to limited ICT infrastructure, passive students, unconsciousness of student and teachers own informational capabilities and poor pedagogical skills. They recommended resolutions on the foregoing factors in a bid to promote critical thinking skills in university education (Hepworth & Duvigneau 2012). Although the issues discussed in the research were directed towards traditional education, they have been found in other studies to be key success factors in the design and delivery of e-learning (Adam, 2003).

1.2 Statement of the Problem

It is generally agreed that ICT has potential to revolutionize scholarship and teaching. However, the general agreement by scholars is not matched by operational strategies for building the capacity of faculty and the universities to use ICT to support their teaching, learning and research (Garrison 2017; Nguru 2014; Albach, Reisberg and Rumbley 2010). In the same vein, the prevalence of ICT in education has also not been matched by equal efforts aimed to inculcating critical thinking skills among learners (Makokha and Mutisya 2016, Lorenzo & Dziuban 2006). Even though some studies on e-learning have showed that students taught using the e-learning instructional strategy will demonstrate a greater improvement in critical thinking over students taught using the traditional instructional strategy (Garrison 2017; Alfadhli and Khalfan, 2009), the continued absence of critical thinking skills in the e-learning pedagogical process has become a major concern worldwide (Garrison 2017; Saade 2012; Brooks and Brooks 2001; King & Kitchener, 1994).

There is evidence to suggest that "the assumption that students improve their critical thinking skills because of university study may not be valid in many African contexts. Concern about the capacity of graduates from African universities to demonstrate 'high-order skills', such as critical thinking, has prompted a growing recognition of the need for pedagogical change within many African higher education institutions" (McCowan 2017). The debate by scholars, students and other stakeholders has been that e-learning platforms have become an information dump where the teachers upload the learning materials for the students to engage in a manner that does not display critical thinking.

The problem is that teachers continue to teach as they were taught even with the prevalence of ICT. There is no progress in how we teach, despite what might be possible with the new technology (Garrison 2017; Makokha and Mutisya, 2016; Harasim, 2016; Zemsky and Massy 2004; Garrison and Anderson, 2003). Students have not been oriented and supported enough on the nature and process of e-learning systems (Garrison and Anderson 2003), the platforms and pedagogies in use merely integrate technology into traditional ways of thinking devoid of the much-needed critical thinking skills. As such, there is clearly a need to understand how we can create critical thinkers and support worthwhile educational outcomes using ICT (Garrison, 2017; Harasim 2016; Garrison, Anderson & Archer, 2000; Garrison, Anderson & Archer, 2001).

Understanding and solving the problem will contribute greatly to research, theory and practice of e-learning. Therefore, the purpose of this study was to examine the relationship between the

ICT Applications and undergraduate students' critical thinking skills in e-learning in selected universities in Kenya.

1.3 Research Question

Is there a relationship between the ICT applications and undergraduate students' critical thinking skills in e-learning?

2.0 LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Social Constructivism Theory

The theory of constructivism is traced from the works of Dewey (1933, 1938), Bruner (1990), Piaget (1972) and Vygotsky (1978). As a theory of learning, Constructivism is a continuum of theoretical systems namely cognitive, radical and social constructivism. Cognitive constructivism focuses on the creation of mental structures that are necessary to hold memory and learning. Radical constructivism assumes that knowledge is adaptive and is constructed by the individual based on his or her own experience.

According to Social constructivism, learning occurs within a community of learners interacting with each other, the content and with the teachers. Dewey initiated constructivism on the basis that schools ought not to focus on repetitive, rote learning but on real world practical learning within which learners demonstrate creativity and collaboration. Piaget proposed that learning is a dynamic process that involves a process of adaptation and assimilation as one encounters new knowledge. According to him, learners construct their own knowledge by creating and testing own theories of the world. Bruner initiated problem-based discovery learning in which learners build their own knowledge based on existing knowledge and in dialogue with the teachers.

Vygotsky developed social constructivism in which he opined that learning occurs within a social context. The assumptions of social constructivism are that the learner is actively constructing knowledge with the aid of colleagues in the learning context. Learning occurs within the context of collaboration among learners. Learning involves active cognitive processing, is adaptive, subjective, and not objective and involves both social/cultural and individual processes.

Social constructivist pedagogy envisages learning as taking place in authentic and real-world environments. It should involve social negotiation and mediation. Content and skills should be made relevant to the learner and be within the framework of the learner's prior knowledge. Students should be assessed formatively, serving to inform future learning experiences. They should be encouraged to become self-regulatory, self-mediated, and self-aware. Teachers serve primarily as guides and facilitators of learning, not instructors. They should provide for and encourage multiple perspectives and representations of content (Doolittle 2017).

Social constructivism is limited in that novice students, deficient in discipline knowledge may construct knowledge that does not correspond with reality or draw unclear or untrue conclusions if they are expected to act as "experts" while engaging in constructivist dialogue with little or no direction from the teacher (Krahenbuhl 2016). On the other hand, constructivist pedagogy can end up being fragmented and inconsistent especially with ill prepared teachers to the detriment of the students. Further, constructivism in general is too relative and ignores the possibility of objective knowledge (Krahenbuhl 2016).

Regarding the promotion of critical thinking skills, constructivism contributes more value to critical thinking. For social constructivists, critical thinking skills develop through reflection and discussion, hence the source of knowledge. When compared with Garrison's (2017, 2000)

Community of Inquiry (CoI) theoretical model, a constructivist learning environment needs to have satisfactory levels of social, cognitive and teaching presence to create a meaningful educational experience. There needs to be high interaction between learners, instructors and the content (Ally 2011).

2.2 Empirical Review

The introduction of e-learning requires that we understand how ICT will be deployed to achieve critical thinking skills. There is a general agreement that the use of ICT in e-learning requires new notions of pedagogy (Garrison 2017; Herring, Koehler & Mishra, 2016). If applied in line with the CoI model, prevalent ICT have the potential to solve the challenges that hindered critical thinking in distance learning and traditional education namely feedback and meaningful discourse (Garrison, 2017).

Studies conducted on the state of e-learning as a course delivery method in Kenyan universities reveal that “universities adopt a variety of software in performance and execution of e-learning activities. The features of the ICT applications in use are custom made and support e-learning activities. There are no students who undertake their courses purely via e-Learning rather what is applied is blended learning where both e-Learning and face to face sessions are utilized” (Murage, 2013). A growing body of literature indicates that the nature and type of applications integrated in the course design has the possibility of enhancing the process for the development of critical thinking skills by way of providing a platform for a thought-provoking environment, discourse, interactivity and collaborative approaches to learning (Garrison, 2017; Gharib *et al.*, 2016).

Garrison, Anderson and Archer (2000) agree that proper deployment of technology may lead to the achievement of wide-ranging educational outcomes. Different media have potential to address cognitive, social and teaching presence as envisaged in the CoI theoretical model. However, there is need for more studies to establish specific ways in which technology could be employed in instructional design, teaching and facilitating learner’s interaction in the CoI to promote purposeful inquiry which leads to development of critical thinking skills. This is because the simple availability of technology without application of relevant didactic approaches will not automatically lead to the promotion of critical thinking skills (Garrison, 2017; Garrison, 1997; Bonk & Reynolds, 1997). Although the introduction of digital technologies in higher education was predicted to bring increased gains among students including allowing for learners to develop critical thinking skills, there is a mismatch between the sweeping expectations of digital technologies in higher education and their actual effects on teaching learning practices (Guri-Rosenblit, 2010).

There are various ICT applications that may be used in the delivery of e-learning. According to Katz and Oblinger (2000), these applications may be classified in terms of flexibility and interactivity up to the fifth generation. The first generation is largely represented by print and is flexible regarding time and place but not interactive. The second generation include audio tape, video tape, computer based learning, and interactive video. This generation of ICT applications are also flexible in terms of time and place. Audio and video tape are not interactive, while computer based learning and interactive video have advanced interactive delivery. The third generation is named the tele learning generation and includes audio conferencing and video conferencing. These are not flexible in time and place though they are interactive. The fourth and fifth generation applications include interactive multimedia online, internet-based resources, computer-mediated communication, campus portal access to institutional resources. Since Oblinger’s work, other ICT applications have emerged which may be classified as sixth generation. Some of the most popular ones include but not limited to social media like Facebook, WhatsApp, twitter, Instagram, LinkedIn, You Tube, blogs, wikis,

learner management systems, file transfer and storage services such as drop box, google drive and one drive, mobile technologies, open educational resources (OERs), and massive open online courses (MOOCs). The innovation of ICT is too fast to the extent that before one technology is mastered, another emerges.

Technologies that belong to the fourth, fifth and sixth generation of e-learning are highly interactive. They are more likely to promote critical thinking because they are learner-centered, flexible, interactive and easy to navigate (Murage 2013). Learner-centeredness, interactivity and flexibility promote critical thinking by enabling collaboration, exchange of information and inquiry-based learning. These characteristics are recommended for constructivist learning environments.

Some of the options available for universities in Africa have been identified in various studies. These include but not limited to Learner Management Systems (LMS), Microsoft office applications (such as word processing, spreadsheets/excel, databases, statistical packages and outlook for email), DVDs, android apps, streaming audio and video; satellite discs; conferencing; video conferencing; file transfer; google docs, video conferencing and social media tools. The above ICT application can be categorized as Learner management systems, Microsoft office applications, social media tools and online technologies. Below is the explanation for each category.

Learner Management Systems

Learner management systems are software applications that are used to enable design and delivery of course content for teaching and learning. The most commonly used LMS in the African context are Moodle and Blackboard. Moodle is an open source LMS that is user-friendly and comes with a mobile application too. Blackboard is a premium LMS which has advanced interface.

Microsoft office applications

These are software programs that are normally used with Personal computers (PCs), laptops and tablets. They are used for data input and output in computing. Sometimes they are preinstalled in new computers or they are sold separately. In many cases, e-learning in Africa utilizes word processing, Power Points, databases, outlook (for email)

Social Media Tools

These are applications that help to create and share content as a form of social networking and relationship building (Garrison 2017). Normally they are designed to work with websites but also with mobile technology such as tablets and mobile phones. Facebook, WhatsApp, twitter, Snapchat, LinkedIn and Instagram are popular especially among the young people in Africa. Even though they have gained worldwide popularity, social media tools have been accused of superficiality and less sustained thinking (Garrison 2017). A recent study on social media and reflective thought revealed that participants who frequently texted or used social media were less likely to engage in reflective thought. Further, the concept of social networking and engagement has been found not to automatically translate to collaborative, deep and meaningful learning experiences (Garrison 2017; Sanger 2010).

Online Technologies

These ICT applications are web based and are normally used to create, store and share content. Some like video conferencing are used as synchronous ways of delivering course material akin to face to face in traditional learning environments. Online technologies such as Open Education Resources (OERs) and Massive Open Online Courses (MOOCs) are used as repositories of free course content offered for free from reputable institutions of learning. Other

online applications include You Tube normally used for streaming audio and video content stored by experts and institutions worldwide. In MOOCs, students have an option to respond or not. This raises serious questions about their value.

Mobile Technologies

These applications range from laptops, tablets, iPads, smartphones and personal digital assistants (PDAs). It is not quite clear how useful these devices could be other than rapid and seamless access to information and learning support (Garrison 2017). Mobile technology has been found to be disruptive and distractive to productive learning unless they are regulated and directed towards the achievement of expected learning outcomes (Garrison 2017; Brooks, Dahlstrom, Grajek and Reeves 2015).

Overall, the review of the literature suggests an intersection of technology and pedagogy in proper delineation for meaningful learning experiences whether for e-learning or traditional learning environment. The general agreement among scholars is that curriculum should drive technology and not the other way around (Garrison 2009, 2017). It is important to demonstrate the importance of ICT in the facilitation of the three presences in the CoI (Garrison 2017). There is a gap in literature regarding the ranking of ICT applications with respect to their inherent propensity for promotion of critical thinking in e-learning. Although there are premises that support the fact that those in the fifth and sixth generation are interactive and capable of initiating critical discourse (Murage 2013), there are no substantive research findings that address the issue of whether these ICT applications can inherently promote critical thinking skills. In the end, the style adopted by the teacher in using the said applications will determine the outcome. As such, one ICT application may end up achieving meaningful learning outcome when used by one teacher who adopts a specific style but then have different outcomes for a different teacher who varies his or her approach. As Garrison (2017) puts it “there is much work to be done about how to effectively use learning technologies for a worthwhile educational experience.”

3.0 RESEARCH METHODOLOGY

The study applied the quantitative approach in data collection and analysis plus a descriptive correlational design. Systematic Random sampling was used to draw a sample of 169 students in four selected universities in Kenya. The focus was on undergraduate students taking e-learning who were in their third and fourth year of study. The researcher generated both descriptive and inferential statistics using statistical package for social sciences (SPSS). The findings are presented using tables.

4.0 RESEARCH FINDINGS AND DISCUSSION

4.1 Descriptive Analysis

The research question sought to inquire the relationship between ICT applications and undergraduate students’ critical thinking skills in e-learning. In the process, the study determined the status of undergraduate students’ information communication and technology use in their e-learning. The respondents were asked to indicate the ICT applications they used while studying in the e-learning unit they took.

The results revealed that majority of the Microsoft office applications were used while studying in the e-learning unit. Microsoft word was ranked high in terms of use with 87.6%, followed by Microsoft PowerPoint with 62.1%, Microsoft Excel with 57.4% while Microsoft Assess was ranked lowest with 40.2%. This means that by the time these university students were in their third and fourth year, they were able to use basic Microsoft office application in the course of

their e-learning. These findings are understandable considering that in many African universities, it is recommended that students buy a laptop at the point of admission. The submission of their assignment is also expected to be typed from the first year. As such, the first two years are enough to give them proficiency in the use of Microsoft office applications. Very few courses within the schools studied use Microsoft Access since it is related to data input and presentation. This may be responsible for low usage among students.

For the ICT applications categorized within Learner Management systems, discussion forums ranked higher in use (60.9%), followed by Chats (43.2%), Moodle Learning Platform (38.5%) Blogs (29%) and Moodle App (26.6%). Within this categorization, crossword puzzle registered the lowest use (19.5%). This means that students have not been oriented enough on the relevance of other tools integrated in the Learner Management System (LMS) which they may use in the course of their learning. It may also mean that although the applications were integrated in the LMS, they may not have been used in the design of many of the courses undertaken. This is understandable because for the most part, e-learning is nascent in many ways in Africa. Many of the universities involved in the design and delivery of e-learning are also learning how these applications may be applied in the African context.

Regarding Social Media Tools, Majority of the respondents used WhatsApp (73.4%) while the rest were rated less than 50% in terms of use in e-learning. LinkedIn and SMS registered the lowest use at 22.5% and 31.4% respectively. This means that many students have been able to integrate the use of WhatsApp in their educational transactions. For the most part, WhatsApp is used for social purposes in Africa. The fact that it recorded the highest use may imply that different teachers in different courses have adopted its use in e-learning. However, much needs to be done in introducing other social media applications in e-learning. Some of the social media tools such as Facebook, LinkedIn, Instagram and SMS were not created with propensity for e-learning unless they are optimized for that function.

In the case of Online Technologies, online quiz, E-books and Email were rated more than 50% in terms of use but the other online technologies had a rating of less than 50% thereby indicating they were not commonly used in studying e-learning units in the previous semester. In this category, E-mail was highly used (66.9%) while Games App and DVDs registered the lowest usage at 16.6% and 13.0% respectively. This means that universities have not oriented their students enough on the use and relevance of online technologies for their e-learning. It may also mean that technologies not commonly used were not integrated in many of the courses in the recollections of the students.

Table 1: Results on ICT Applications and Features Used

ICT Applications		Features	Not used Count	%	Used Count	%
Microsoft Applications	Office	Microsoft Word	21	12.4%	148	87.6%
		Microsoft PowerPoint	64	37.9%	105	62.1%
		Microsoft Excel	72	42.6%	97	57.4%
		Microsoft Access	101	59.8%	68	40.2%
Learner Systems	Management	Moodle App	124	73.4%	45	26.6%
		Moodle Learning Platform	104	61.5%	65	38.5%
		Crossword Puzzle	136	80.5%	33	19.5%
		Blogs	120	71.0%	49	29.0%
		Discussion Forums	66	39.1%	103	60.9%
		Chats	96	56.8%	73	43.2%
Social Media Tools		Facebook	87	51.5%	82	48.5%
		WhatsApp	45	26.6%	124	73.4%
		Instagram	100	59.2%	69	40.8%
		Twitter	111	65.7%	58	34.3%
		SMS	116	68.6%	53	31.4%
		LinkedIn	131	77.5%	38	22.5%
Online Technologies		Video Conferencing	124	73.4%	45	26.6%
		Facetime	141	83.4%	28	16.6%
		Calls	116	68.6%	53	31.4%
		DVDs	147	87.0%	22	13.0%
		You Tube	96	56.8%	73	43.2%
		Games App	130	76.9%	39	23.1%
		Online Quiz	73	43.2%	96	56.8%
		Online Survey	109	64.5%	60	35.5%
		Web Links	126	74.6%	43	25.4%
		E-books	74	43.8%	95	56.2%
		Email	56	33.1%	113	66.9%

4.2 Relationship between ICT Applications and Critical Thinking Skills

The research question sought to determine the relationship between ICT applications and undergraduate students' critical thinking skills in e-learning. In connection with research question, the hypothesis was stated in null form that *there is no statistically significant relationship between ICT applications and undergraduate students' critical thinking skills in e-learning*. After correlation analysis, the results indicated that there was significant strong positive relationship between ICT applications in use and undergraduate students' critical thinking skills in e-learning. This was supported by a Pearson correlation value of 0.582 and p value of 0.000. Since, the p value was less than 0.05, the null hypothesis was rejected, and it was concluded that there was significant strong and positive relationship between ICT Applications and critical thinking skills. The correlation results are presented in Table 2.

Table 2: Correlation between ICT Applications in Use and Critical Thinking Skills

			Critical Thinking Skills	ICT Applications in Use
Critical Skills	Thinking	Pearson Correlation	1	.582*
		Sig. (2-tailed)		0
ICT Use	Applications in	Pearson Correlation	.582*	1
		Sig. (2-tailed)	0	

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

The results mean that there is a high likelihood that prudent use of ICT applications can lead to the development of critical thinking skills. The demonstration of weak critical thinking skills, however, may mean that even though the use of ICT applications may have a high likelihood of developing undergraduate students' critical thinking skills, it is not the only factor at play in this process. Just because ICT applications are integrated or used does not guarantee the development of strong critical thinking skills. The way they are deployed will likely determine the attainment of strong critical thinking skills or not.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The study found that use of ICT applications and undergraduate students' critical thinking skills in e-learning are positively and significantly correlated. The relationship was found to be strong. Following the results, the null hypothesis was rejected and therefore, it was concluded that there was a statistically significant relationship between use of ICT applications and undergraduate students' critical thinking skills in e-learning. It should be noted that the ICT applications correlated were those found to be largely used by the students in the course of taking e-learning rather than a direct correlation for all of them.

5.2 Conclusion

From the findings of this study, we conclude that the integration and use of ICT in e-learning holds a great promise for the promotion of critical thinking skills in e-learning. However, the fact that the skills demonstrated were weak might speak to the presence of other factors that work together with ICT integration and use to promote strong critical thinking skills among e-learners. As such, mere integration and use of ICT in e-learning does not guarantee that meaningful learning characteristic of Critical thinking will occur.

5.3 Recommendation

The results of this study reveal that even though universities adopted a variety of ICT applications in e-learning, only a few were used by the students in their learning. This means that students lack support and orientation to the relevance and use of ICT applications used to design and deliver e-learning. For effective e-learning capable of developing students' critical thinking skills, students need to be oriented on the relevance and use of ICT applications integrated in their e-learning platform. Future research needs to address itself to the question of propensity of ICT applications to influence critical thinking process to establish whether they may be ranked against each other with respect to their capacity for promoting critical

thinking skills. In the same vein, we need to find ways in which ICT applications of interactive and discursive nature such as WhatsApp and other social media tools could be improved for use in promoting critical thinking in e-learning. This is because initially some of the ICT applications were originally designed for social and personal life and not for educational purposes.

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