FULL-LENGTH ARTICLE

Determinants of Instructor's Information and Communication Technology (ICT) Use in Higher Education: A Scoping Review

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ABSTRACT
Information and communication technology (ICT) has the potential to improve the quality of and access to higher education. With this understanding, many higher education institutions in both developed and developing countries have invested huge money to expand ICT infrastructures. Despite considerable investment, ICT as a tool for promoting learning is not generally well used for teaching and learning purposes in Higher Education (HE). This scoping review, therefore, aims at investigating determinants of instructors' educational use of ICT in higher education. In this study**,** 31 studies published in different international journals were reviewed to identify major determinants of ICT use by instructors. The review showed that institutional characteristics (policy and regulation, reward and motivation, infrastructure, funding, support, and professional development), individual characteristics (ICT perception, ICT attitude, ICT competence and time of instructors) and pedagogic factors (instructor's pedagogic understanding and belief, and pedagogic support) are major determinants of instructor's educational use of ICT. There is also evidence in this review that researches in African HE and the rest of the world differ in their focus areas. The findings from African HE show that institutional factors are the most widely reported determinants of ICT use by instructors in higher education. Finally, it is recommended that future studies should focus on a quantitative explanation of the complex interplay between these determinants and ICT use. Future studies should also focus on identifying determinants with strong predictive power to develop a tailor-made and at the same time efficent model of ICT use in higher education.

Keywords: Higher education; ICT use; instructors; scoping review

INTRODUCTION

The fast growth of ICT, defined for the purpose of this study as laptops, desktops, computer hardware and software, computer applications and networks that are used by instructors in Higher Education (HE) to assist classroom teaching and learning, has given rise to the expectation that new technologies would significantly influence the quality of education (Braak et al., 2004). These new technologies have brought profound changes in education (Harden, 2002). Specifically, ICT has changed how teaching and learning is practiced and taught (Karsenti et al., 2008). The rapid development of computer technology and access to a personal computer, together with the internet, e-mail, and various education literature retrieval applications, have changed both the study and practical environment in higher education (Nattestad, 1999). For instance, the introduction of ICT in education has enabled better implementation of competence-based curricula (Oliver, 2002). In addition, ICT has improved the implementation of student-centered instruction by enhancing students' engagement and interaction (Jung, 2000; Capper, 2003; Jones, 2004) and enabled learning flexibility (in terms of time and place) in HE (Hattangdi & Ghosh, 2008; Hong & Songan,

2011). Furthermore, ICT enabled HE internationalization to take place in a more effective and efficient way (Fava-de-moraes & Simon, 2000). In the 21st century, Higher Education Institutions (HEIs) are challenged with the growing and diversified needs of learners and employers. More than ever before, employers are in need of skilled and competent labor force to enhance their efficiency and effectiveness. This entails that HEIs need to train competent professionals in order to satisfy the need of their employers. Parallel to this, in response to globalization and internationalization, these institutions by now are required to incorporate activities such as faculty and students exchange, joint programs, program franchising, development of subsidiary institutions abroad, and trans-national distance education. If HEIs are to respond to these challenges and become competitive, the integration of ICT into their teaching and learning activities will be unavoidable (Collis & Wende, 2002).

Studies on the impact of ICT on students' learning so far show inconsistent insights. Even though some studies show the absence of any effect of ICT on teaching (Woessmann & Fuchs, 2014), a growing body of literature provides evidence of the positive effects of the use of ICT on students' learning (Mumtaz, 2000). Regardless of the impact of ICT use on student learning, the integration of ICT into teaching has a number of benefits for students. When ICT is used based on sound learning theories and principles, it has the potential to increase access to information and learning resources (BECTA, 2003) and enables learning to be available at any time and place (Hong & Songan, 2011). The use of ICT further improves interactions between students and learning materials, between students and instructors and among students themselves so that learning becomes interactive (Capper, 2003; Yusuf, 2005).

Moreover, ICT enables students to develop the required competencies (Davis & Tearle, 1999, Capper, 2003) by relating classroom experiences with the workplace (Davis & Tearle, 1999). The integration of ICT into teaching and learning enables students to develop critical thinking and problem-solving skills, creativity and innovation, communication and collaboration, and development of ICT skills (Balanskat et al., 2011), which are highly demanded by the labor markets. ICT may also serve as a tool for curriculum differentiation and provide opportunities for adapting the learning content and tasks to each pupil's needs and capabilities (Smeets & Mooij, 2001).

The governments and HEIs can also be beneficiaries of the integration of ICT into teaching and learning. This is due to the fact that ICT use improves education management and provision of educational services and make such services more cost-effective (Mumtaz, 2000; UNESCO, 2002). It also helps the HE|Is to reach the target group with limited access to conventional education programs (UNESCO, 2002).

Contrary to this, studies also revealed that the use of ICT has no impact on students' learning (e.g. Cox & Marshall, 2007). Studies further found that there is no significant difference between students' achievement and learning satisfaction between traditional and ICT supported mathematics classrooms (e.g., Bernard et al., 2004). Also, there are arguments in the literature that ICT use in education reduces face-to-face contact between students and teachers, encourages cheating during an assessment, exposes students to plagiarism, and is not suitable to teach practical lessons (e.g., science lessons) (Arkorful , 2014).

Despite the widespread understanding of the relevance of using ICT in education, ICT as a tool for promoting learning is not generally well used for teaching and learning purpose in

HE of both developed and developing countries (Zhao & Cziko, 2001; Ellaway, 2011; Martirosyan et al., 2017). Strangely enough, the level of ICT use by instructors for academic purpose is not satisfactory even in HEIs where ICT infrastructures are reasonably available (see e.g., Martirosyan et al., 2017). In many countries, ICTs were introduced into educational institutions not as a means of improving teaching and learning activities but as an end by itself (Young, 1991). Such misconceptions seem to have compromised the use of ICT and its resultant impacts.

To summarize, ICT is crucial for improving the quality of and access to education. Cognizant of this, some countries have been expanding ICT infrastructures in their HE. Nevertheless, these HEIs have been continued to be constrained in using ICT to improve teaching and learning activities. Therefore, it is timely and imperative to study the practice of ICT use in HE and determinants of its use. The purpose of this scoping review is, therefore, to investigate issues surrounding instructor's adoption of ICT in the HE context.

Need for the current review

Several researchers reviewed the existing knowledge on the use of various ICT resources in the context of HE (e.g., Basak et al., 2016; Bervell & Umar, 2017; Kaliisa & Picard; 2017). From the study of systematic reviews carried out until 2017, one can learn that the reviews have different purposes, scopes, and study subjects that make them incomprehensible. Some of the reviews (e.g., Means et al., 2009; Rowe et al., 2012; Bernard et al., 2014) exclusively focus on the impact of using e-learning technology on students' academic achievement. However, these studies failed to consider the role and voice of instructors in implementing e-learning in HE and its resultant impacts on students' adoption of ICT. Other studies that can be seen under this category are reviews that focused on the impact of e-learning on students' academic achievement and factors that affect its implementation (e.g., Button et al., 2014). This study reviewed the impact of e-learning on students' achievement and associated factors. However, the scope of the target group is delimited only to a specific discipline, i.e., nursing students.

Other reviews focus on exploring different (success) factors to the implementation of e-learning in universities. Some studies reviewed determinants of e-learning in higher education with a focus on specific constructs (see for e.g. Alrasheedi & Capretz, 2013; Button et al., 2014; Rohayani et al., 2015; Rahman et al., 2017). The limitation of these reviews is that the factors explored are not all-inclusive and hence do not provide a complete picture of the factors. The studies, for instance, did not sufficiently address institutional factors for the successful adoption of ICT in HE. Only a limited number of studies (e.g. Šumak et al., 2011; Basak et al., 2016; Bervell & Umar, 2017) extended their review to capture individual and institutional level factors to the adoption of e-learning in HE. In addition, most of the reviews focused on studies whose subjects are students. Thus, a review of studies that focus on instructor's ICT adoption and its determinants is imperative as instructor's ICT usage behavior may influence students' intention and actual ICT use. Furthermore, most of the aforementioned reviews considered studies that were carried out before 2014. Because studies in the area of educational use of ICT are becoming the interest of many researchers and consequently, many publications are coming out, it is quite reasonable to review the latest publications to see recent developments focusing on determinants of instructor's ICT adoption in HE context. Such a review will throw light on whether or not previously addressed barriers and enablers of ICT adoption have continued to influence the same. In sum, a review of recent studies on determinants of the educational adoption of ICT by instructors in the context of HE is in short supply. This review, therefore, aims at answering the questions:

a. What factors determine instructor's adoption of ICT in HE?
b. How are the findings on the determinants of instructor's ICT use in HE in Africa are compared to the rest of the world?
c. What are the possible implications of the findings of the current review of future studies?

MATERIAL AND METHODS

This review employed scoping review technique. The researchers employed scoping review as the technique enables to (a) map the key concepts underpinning determinants of ICT use, as well as to clarify working definitions, and/or the conceptual boundaries of a topic (Arksey & O'Malley, 2005); (b) examine emerging evidence when it is still unclear what other, more specific questions can be posed and valuably addressed as it is the case in this study (Anderson et al., 2008); (c) examine and clarify broad areas to identify gaps in the evidence, clarify key concepts, and report on the types of evidence that address and inform practice in ICT use in HE (Anderson et al., 2008) and (d) scrutinize the extent, range, and nature of research activity in a particular field while encompassing both empirical and conceptual research with broadly framed questions.

This review followed the following key steps of scoping review developed by Arksey and O'Malley (2005). These are:

1. Identify the research questions: what domain needs to be explored?
2. Find the relevant studies through the usual means: electronic databases, reference lists (ancestor searching), websites of organizations, conference proceedings, etc.;
3. Select the studies that are relevant to the question(s);
4. Chart the data, i.e., the information on and from the relevant studies
5. Collate, summarize and report the results
6. (Optional) consult stakeholders (clinicians, patients, families, policymakers, or whatever is the appropriate group) to get more references, provide insights on what the literature fails to highlight, etc.

Search Databases

The very purpose of this scoping review is to examine factors that determine instructor's successful adoption of ICT for educational purpose in HE. For the purpose stated above, primary research studies were mainly searched from Elsevier, ProQuest, Science Direct, ERIC, Social Science Citation Index and Google Scholar research databases.

Search strategy

Search strategy encompasses search words, a combination of the words, and inclusion and exclusion criteria. The subsequent section presents each of the search strategy components.

Search Words

Search for articles were carried out using a combination of different keywords. This includes *ICT adoption, ICT integration, E-learning, blended learning, hybrid learning, technology use, technology acceptance, ICT usage, ICT use* in combination with *teachers, faculty, instructors* and *higher education, post-secondary and university.* The search was carried out with the following combination of words.

(Determinants OR factors) AND (ICT OR technology OR E-learning OR "blended learning" OR "hybrid learning") AND (adoption OR integration OR use OR usage OR acceptance)

AND ("higher education" OR university OR post-secondary) AND (teachers OR faculty OR instructors) NOT (students AND school AND k-12").

Inclusion and Exclusion Criteria

Studies obtained from the aforementioned databases were included in the review based on the following criteria. For a study to be included in this study, it must pertain to the educational use of ICT in HEIs, has been published in the last five years (since 2015), be published on peer reviewed journal, published in English, be a full text journal article, be published in HE context and its design can be quantitative or qualitative or mixed-research design. Technical papers, reviews and papers published on proceedings, studies that considered students as a subject of study and those based on literature review were not included in this review.

Charting the Data

Data were extracted into table with details about every study. The data extraction sheet includes authors, year of publication, title, research design, location, participants, design and major findings.

Quality Appraisal Criteria

In order to ensure the quality of the review, the authors included only articles published in peer-reviewed journals. In addition, every article was critically evaluated against the inclusion criteria before being included in the analysis. Moreover, we used research appraisal standard criteria developed by JBI-SUMARI to appraise both quantitative and qualitative research.

Data Analysis and Synthesis

The unique purpose of a scoping review is to aggregate the findings and present an overview rather than a meta-synthesis reporting results on narrowly defined questions. Consequently, findings of the selected studies were coded, thematically categorized, summarized and described based on the review questions. Presentations of the findings are supported with illustrations to support readers to easily understand the synthesis of the findings.

RESULTS AND DISCUSSION

By combining the above search words in different combinations, 44 studies (26 Elsevier, ProQuest, Science Direct, Social Science Citation Index, 8 from ERIC and 10 from Google Scholar) were identified. After the final appraisal, 31 articles were selected for the final review.

As indicated in Table 1, USA and Asia are the highest publishing countries, combined contributing to 45% of published papers, followed by Europe and Middle East combined contributing to 38% of the published works. Canada and Africa are the least publishing countries contributing 13% and 3%, respectively. USA is the highest contributing country. In terms of methods of the studies, the majority 17 (54.8%) adopted a quantitative research method followed by a qualitative research method, which accounted for 12 (38.7%) of the studies. This implies that USA and Asia dominate publication on determinants of ICT use in HE. After reading and rereading the results and conclusion of the studies, the researchers identified the following codes from the reports (Table 2).

As it can be seen from Table 2, the study came up with twenty-two determinants of instructor's ICT. These determinants were further clustered into 11 categories based on the

relevance of concepts/ideas embedded in the determinants: determinants and their respective descriptions and sub-components (Table 3).

Table 1. Description of Profiles of the Reviewed Studies by Region and Study Method

By region							By study method				
Africa	Asia	Europe	Middle east	Canada	USA	Total	Quantitative	Qualitative	Document analysis	Mixed research	Total
4 (13%)	7 (22.5%)	6 (19%)	6 (19%)	1 (3%)	7 (22.5%)	31	17 (54.8%)	12 (38.7%)	1 (3%)	1 (3%)	31

Table 2. List of Determinants Identified from the Review

S.No	Codes /determinants	Studies from which the codes are identified	Frequency of appearance in the studies
1	ICT attitude	(Gillies, 2016), (Martirosyan et al., 2017), (Al-Shboul, 2014), (King & Boyatt, 2014), (Livingstone, 2015)	5
2	Access	(Gillies, 2016), (Livingstone, 2015), (Bakir, 2015)	3
3	Institutional support	(Gillies, 2016), (Blackburn, 2017), (Kisanga & Ireson, 2015),(Al-Shboul, 2014), (Bousbahi & Alrazgan, 2015)	5
4	Administrative support	(Livingstone, 2015), (Al-Mushasha & Nassuora, 2012), (Ayele & Birhanie, 2018), (Zhu, 2015), (Bakir, 2015)	5
5	Professional development	(Bakir, 2015),	1
6	Technological support	(Raphael & Mtebe, 2016), (Bridget, 2016), (Bakir, 2015), (Sang a, 2016), (Bridget, 2016), (Martirosyan et al., 2017),	5
7	Funding	(Bakir, 2015), (Blackburn, 2017), (Bridget, 2016), (Newton, Tucker, Dawson, & Currie, 2014), (Fatih Güllü, Rein Kuusik, Mart Laanpere, 2015), (Bekteshi, 2015),	6
8	Faculty pedagogic belief	(Bakir, 2015)	1
9	Policy and regulation	(Tuul, Banzragch, & Saizmaa, 2016), (Bridget, 2016)	2
10	Quality of training received	(Zander, 2016)	1
11	Infrastructure	(Kisanga & Ireson, 2015), (Bousbahi & Alrazgan, 2015), (King & Boyatt, 2014), (Mirzamohammadi, 2017), (Bridget, 2016), (Zander, 2016)	6
12	Internet	(Bridget, 2016), (Zander, 2016)	2
13	Training	(Zander, 2016), (Al-Shboul, 2014), (Ayele & Birhanie, 2018)	3
14	Pedagogical support	(Mirzamohammadi, 2017), (Raphael & Mtebe, 2016), (Hodgson & Shah, 2017),	3
15	Time	(Long, Cummins, & Waugh, 2017), (Bridget, 2016),	4

		(Martirosyan et al., 2017), (Al-Shboul, 2014)	
16	Motivation and reward	(Bousbahi & Alrazgan, 2015), (Blackburn, 2017), (Bridget, 2016)	3
17	Incentives	(Bridget, 2016), (Shelomovska, Sorokina, & Romanyukha, 2016), (Al-Shboul, 2014)	3
18	Competence	(King & Boyatt, 2014), (Al-Shboul, 2014), (Kisanga & Ireson, 2015), (Castro & Nyvang, 2018)	4
19	Workload	(Al-Shboul, 2014),	1
20	Perceived Usefulness	(Ebrahimi, Moeinikia, & Babelan, 2018), (Mirriahi, Vaid, & Burns, 2015), (Sánchez-Mena, Martí-Parreño, & Aldás-Manzano, 2017), (Teo, Huang, & Hoi, 2018)	4
21	Perceived ease of use	(Mirriahi et al., 2015), (Bousbahi & Alrazgan, 2015), (Sánchez-Mena et al., 2017), (Teo et al., 2018)	4
22	Vision	(Zhu, 2015)	1

Table 3. Determinants and their respective descriptions and sub components

SN	Minor Categories	Description of the minor categories	Determinants in the category
1	ICT attitude	The inclination or the like or dislike of individual instructors towards using ICT	Attitude
2	ICT competence	Teachers own judgment of their skill and knowledge to use ICT.	Competence
3	ICT perception	Teachers own understanding of whether or not using technology is relevant to their job as teachers.	Perceived ease of use, perceived usefulness
4	Support	Backing from the university managing body and technical staff to enhance teachers' adoption of technology in to teaching and learning.	Institutional, administrative, and technology support
5	Pedagogy	Teachers conception of the theories and practice of teaching and learning and the support they receive from their university to keep updated with contemporary pedagogical theories	Pedagogical understanding, pedagogical support, pedagogical belief
6	Professional development	Efforts made by universities and other training institutions to empower teachers to use ICT in teaching and learning.	Professional development, training, quality of training during persevere training.
7	Funding	Financial resources allocated by the university to support he expansion of ICT infrastructures and teachers professional development	Funding
8	Infrastructure	ICT physical resources (e.g. computers, internet) which are fundamental for the adoption of ICT in teaching and learning.	Infrastructure, internet
9	Policy and regulation	A comprehensive framework outlining what universities aspire to be in using ICT, strategies for realizing the aspiration and regulations to implement the strategies.	Policy and regulation, vision
10	Time	What it costs instructors to adopt ICT in teaching and learning in terms of time.	Time, work load
11	Reward and motivation	Motivation and reward mechanisms devised and implemented in universities in order to inspire instructors to use ICT in teaching and learning.	Reward and motivation, incentive

Based on their level of influence and organizational structure hierarchy, the minor categories are further reduced to three major categories of determinants. Description of the major categories and minor categories under the major ones are as illustrated below (Table 4).

Table 4. Major categories, their respective descriptions, and minor categories

Major categories	Description	Minor categories
Institutional determinants	This category encompasses determinants that have an overall impact on ICT use at an institutional level. They cannot be attributed to individual instructors but to the institution managing body at different levels	Reward and motivation, policy and regulation, infrastructure, funding, support, professional development
Individual determinants	This category consists of determinants that can be attributed to individual instructors	Time, ICT perception, ICT attitude, ICT competence
Pedagogical determinants	This category consists of issues related to pedagogy. They can be attributed to both individual and institutional characteristics.	Pedagogy

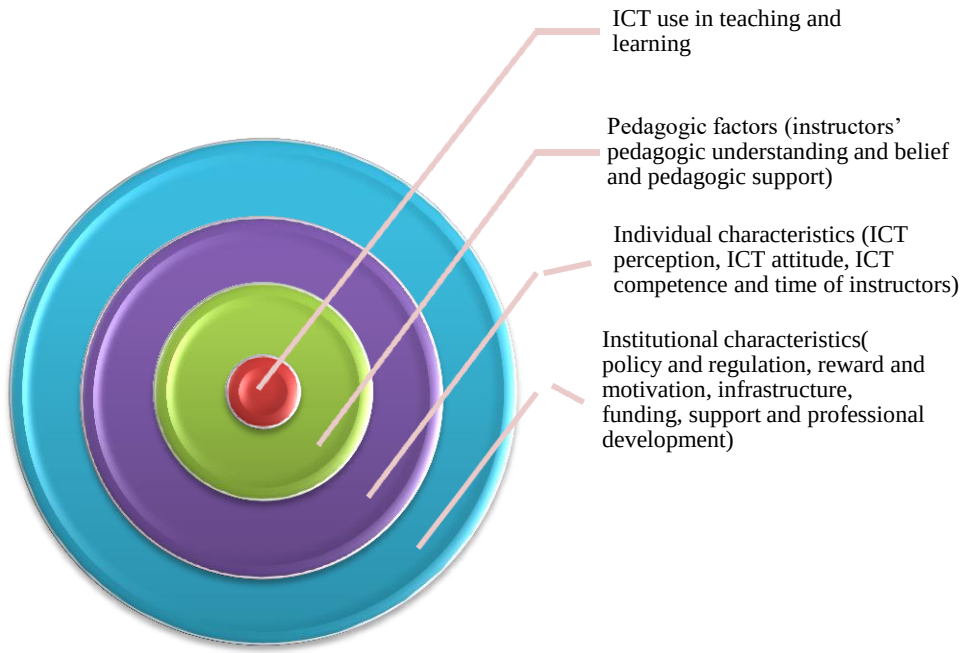

Fig. 1. Determinants of instructor's ICT use in HE

Determinants of instructor's educational use of ICT can generally be categorized into three as institutional, individual, and pedagogical determinants (Fig. 1). Determinants under each of the categories are described as follows.

Institutional characteristics

Institutional determinants refer to determinants that have an overall impact on ICT use at an institutional level and cannot be attributed to individual instructors but to the institutions' managing body at different levels. It consists of policy and regulation, reward and motivation, infrastructure, funding, support and professional development. These determinants have an overall impact in the sense that they have an influence on individual and pedagogical determinants.

Policy and regulation*:* Successful integration of ICT into teaching and learning activities needs proper planning, resourcing, support, and monitoring and evaluation. This means that if ICT is to be appropriately integrated into teaching and learning, it should be guided by a policy that gives a vision and framework for using it (Salik & Zhiyong, 2014). As documented in some of the selected studies, the absence of a clear ICT policy (Bridget, 2016; Tuul et al., 2016) and vision (Zhu, 2015) are among barriers to integrating ICT in teaching learning. In addition, rules and regulations, which refer to bylaws and guidelines developed and implemented by universities in order to enforce instructor's use of ICT for teaching purpose, is also another determinant that can be seen under this category. These rules and regulations provide a common framework regarding the responsibilities of each of the organization's actors, the standard of performance, and the consequence of discharging or not discharging responsibilities. However, as shown in the reviewed literature, the absence of such regulation is challenging the proper integration of ICT in to teaching and learning (Bridget, 2016; Tuul et al, 2016).

Infrastructure*:* Infrastructure refers to ICT physical resources (e.g. computers, internet) which are fundamental for the adoption of ICT in teaching and learning activities. Without these infrastructures, the uptake of any kind of technology is challenging. However, the mere availability and accessibility of ICT infrastructure cannot be taken for granted as the adoption of ICT in HE further demands other conditions such as ICT competence, favorable ICT attitude, ICT support and other pedagogical issues. Yet, supplying instructors with fundamental ICT infrastructure is crucial to realize ICT adoption in teaching and learning activities. As evidenced in the reviewed literature, ICT infrastructure is one of the challenges to the adoption of ICT in teaching and learning in both developing and developed countries (King & Boyatt, 2014; Bousbahi & Alrazgan, 2015; Kisanga & Ireson, 2015; Bridget, 2016; Zander, 2016; Mirzamohammadi, 2017). However, this does not mean that HE in both developing and developed countries equally faces the shortage of ICT infrastructure challenges. Apparently, the degree and scope of the shortage differ. Moreover, the availability of ICT alone is not sufficient. The available ICT infrastructures, regardless of its degree, need to be available to both the instructors and students if it is to be integrated into teaching and learning (Al-Shboul, 2014; King & Boyatt, 2014; Livingstone, 2015; Gillies, 2016; Martirosyan et al., 2017)

Funding*:* Refers to financial resources allocated by universities to support the expansion of ICT infrastructures, instructor's professional development programs and other supports deemed necessary for the adoption of ICT in teaching and learning. Apparently, the purchase of ICT hardware and software, organization of various professional development interventions (training, seminars, workshops) for ICT use and recruitment of ICT technical staff demand money. Money is behind many of the determinants. However, in this review,

shortage and improper funding are identified as one of the determinants of educational use of ICT in HE by a number of studies (Newton et al., 2014; Güllü et al., 2015; Bakir, 2015; Bekteshi, 2015; Bridget, 2016; Blackburn, 2017).

Support*:* Refers to backing from the university managing body and technical staff to enhance teachers' adoption of technology into teaching and learning. In the reviewed studies, both the administrative/institutional and technological supports are identified as determinants of ICT use. Administrative/institutional support refers to the support provided by universities' managing bodies to facilitate the adoption of ICT for teaching and learning purposes. It involves formulating a clear ICT vision, providing ICT infrastructure, supporting instructor's professional development, and providing individualized support and encouragement to instructors. Yet, an abundant body of the reviewed studies showed that administrative support is among the factors that affect instructor's adoption of ICT use into teaching and learning (Al-Mushasha & Nassuora, 2012; Al-Shboul, 2014; Kisanga & Ireson, 2015; Livingstone, 2015; Zhu, 2015; Bakir, 2015; Bousbahi & Alrazgan, 2015; Gillies, 2016; Blackburn, 2017; Ayele & Birhanie, 2018). Another form of support is technological support. Technological support refers to technical ICT support services provided to instructors in order to facilitate their ICT use. Such support is decisive as instructors frequently face technical ICT problems that they cannot fix with their capacity. In many of the reviewed studies absence of strong user technical support is reported as a barrier to ICT use (Bakir, 2015; Bridget, 2016; Raphael & Mtebe, 2016; Sang , 2016; Martirosyan et al., 2017).

Professional development: Refers to training, workshops, and seminars organized by universities to enhance instructor's competence to use ICT in teaching and learning activities. Because new educational technologies and pedagogies have been continuously evolving, instructors need to have a need-based continuous intervention in order to improve their knowledge and skill of using ICT in teaching and learning. Some of this studies indicated that in-service training is vital in enabling instructors to use ICT (Al-Shboul, 2014; Zander, 2016; Ayele & Birhanie, 2018). In addition, the quality of training instructors receive during their preserve training also determines their ICT use (Zander, 2016).

Motivation and Reward*:* Refer to mechanisms devised and implemented in universities in order to inspire instructors to use ICT in teaching and learning. Motivation energizes individuals to take or not to take a certain action. By the same token, it determines instructor's engagement/non-engagement in adoption of innovations like ICT into teaching. The adoption of ICT demands instructors to invest their time in attending relevant training and designing ICT- integrated instruction. Instructors, therefore, need incentive that energizes them to use innovations like ICT in their teaching and learning activities (Al-Shboul, 2014; Bousbahi & Alrazgan, 2015; Bridget, 2016; Shelomovska et al., 2016; Blackburn, 2017).

Instructor's Characteristics

This category consists of determinants that can be attributed to individual instructors. It consists of ICT perception, ICT attitude, ICT competence and time of instructors.

ICT competence: Refers to instructor's skill and knowledge to use ICT. Apparently, technology adoption needs fundamental knowledge of the technology and pedagogy and skill of operating various ICT devices. Working with technology without having basic ICT competence will challenge users and make them develop a negative attitude and eventually

results in users' resistance to technology adoption. Many studies in this review indicate that lack of ICT knowledge and skill is among the barriers to instructor's educational use of ICT (Al-Shboul, 2014; King & Boyatt, 2014; Kisanga & Ireson, 2015; Castro & Nyvang, 2018).

ICT attitude*:* Refers to the inclination or the like or dislike of individual instructors towards using ICT. Instructor's attitude toward ICT influences their use of ICT. Instructors who possess a favorable attitude towards ICT tend to use ICT more likely than those who possess an unfavorable attitude. In favor of this argument, some of the reviewed studies indicated that instructors attitude towards ICT use determines their use or not use of ICT (Al-Shboul, 2014; King & Boyatt, 2014; Livingstone, 2015; Gillies, 2016;Martirosyan et al., 2017).

ICT perception: Refers to teacher's own understanding of whether or not using technology is relevant to their job as teachers. It encompasses both perceived ease of use and perceived usefulness. Instructor's perception of the usefulness of ICT in facilitating their teaching tasks and their own judgment of manageability of using the technology influences their level of ICT use. Findings of the reviewed studies indicate that instructor's ICT use is determined by both perceived ease of use (Bousbahi & Alrazgan, 2015; Mirriahi et al., 2015; Sánchez-Mena et al., 2017; Teo et al., 2018) and perceived usefulness (Mirriahi et al., 2015; Sánchez-Mena et al, 2017; Ebrahimi et al., 2018; Teo et al., 2018).

Time*:* Refers to what it costs instructors to adopt ICT in teaching and learning in terms of time. It encompasses time invested by instructors to attend training, plan, develop and organize courses to deliver using ICT. The use of ICT in teaching and learning activities demands sufficient preparation. Teachers need to attend relevant trainings, search and organize learning material to make them suitable to the needed learning format. In addition, instructors may not easily master working with new technologies after a while and they need continuous exercise in which case they need to invest more time on it. Using ICT therefore demands more time than teaching without ICT. This implies that the extent of ICT use by instructors is contingent upon the available time they have. Many studies in this review showed that time of instructors is among the significant determinants of ICT use in education (Al-Shboul, 2014; Bridget, 2016; Long et al., 2017; Martirosyan et al., 2017).

Pedagogic Factors

Pedagogic factors refer to instructor's conception of the theories and practices of teaching and learning, and the support they receive from their university to keep themselves updated with contemporary pedagogical theories. It consists of instructor's pedagogic understanding and belief and, pedagogic support they receive in order to strengthen and improve their pedagogic skill. The generic ICT technical skill is not sufficient in order to integrate ICT in an innovative manner. The integration of ICT should be guided by appropriate pedagogic theories. This implies that if ICT is to be effectively used in teaching, instructors need to have the required expertise in pedagogy and technology as well. The reviewed studies indicated that instructor's level of ICT integration is determined by their knowledge and perspective on how effective teaching and learning occurs (Bakir, 2015). The reviewed studies further indicated that if instructors have to integrate ICT based on sound learning theories, they need to be continuously updated with emerging innovative pedagogies (Raphael & Mtebe, 2016; Hodgson & Shah, 2017; Mirzamohammadi, 2017)

Determinants of ICT use in HE in Africa

In the reviewed articles, four studies have their origin in HE in Africa. Most of the determinants in HE in Africa are institutional factors. The institutional determinants are mainly ICT infrastructure (computers and internet connectivity), support (administrative and technical) and professional development (training on ICT skill). These determinants are also evidenced in non-African studies. However, the degree and scope of some of the determinants such as ICT infrastructure and funding may vary. These determinants consistently appeared in all studies in Africa (see Kisanga & Ireson, 2015; Bridget, 2016; Raphael & Mtebe, 2016; Ayele & Birhanie, 2018) but not in all non-African studies. The other determinant group is individual characteristics that include ICT competence, incentives and motivation, and instructor's resistance. Though ICT competence is a common determinant across African and non-African studies, the other determinants, particularly incentives and motivation, and teachers' resistance are peculiar to African studies (Kisanga & Ireson, 2015; Bridget, 2016). Pedagogical factors such as instructor's pedagogical belief and understanding are not substantially evidenced in African based studies. This may imply that studies on instructor's educational use of ICT in African HE mainly focus on institutional issues such as infrastructures. This finding is congruent with the findings of the review of Andersson and Grönlund (2009), who found that most of the studies in developing countries focused on investigating ICT infrastructure. This might not be surprising as studies in developed countries during 1990s did focus on the same determinants as the shortage of infrastructure was a critical factor by then (Andersson & Grönlund, 2009). Shortage of ICT infrastructure and poor institutional support are still fundamental issues that need to be addressed if ICT is to be integrated in HE in Africa.

CONCLUSION

This review identified a number of determinants that influence ICT use in teaching and learning in HE. These determinants are multidimensional in the sense that they can be attributed to the characteristics of individual instructors, pedagogical factors, or institutional characteristics as a whole. The determinants we have identified are incongruent with previous reviews on factors influencing technology integration in HE (see Andersson & Grönlund, 2009; Ali, et al., 2018). Regardless of the way the determinants are categorized, this study evidenced that studies published after 2015 reveal similar determinants with studies conducted before. This implies that factors influencing ICT integration in HE have been consistent over decades though they might differ in their scope and depth across different contexts. There is also evidence in this study that studies regarding determinants of instructors' ICT integration in HE in Africa and the rest of the world differ in their area of focus. The finding of studies on African HE indicated institutional factors such as infrastructure as major determinants of instructor's educational use of ICT.

Recommendations and implications for future studies

The multidimensional nature of ICT determinants of instructors' ICT integration indicates that the uptake and institutionalization of technology in teaching and learning in HE demands a holistic strategy that addresses multilayered determining factors than approaching in a piecemeal way. HE institutions need to devise strategies to address institutional, individual, and pedagogic related factors in an integrated manner. As it has been the case in many HE institutions, huge investment in ICT infrastructure alone cannot realize institutional aspiration to integrate ICT into the teaching-learning activities. It should instead be followed by other works such as devising and implementation a strong user support system and professional development activities for instructors to impact their ICT

competence, ICT attitude and pedagogical beliefs. For this to happen, HE institutions need to have a clear and shared vision of what to achieve with using ICT.

Finally, it is recommended that future studies should focus on a quantitative explanation of the complex interplay between these determinants and ICT use. In addition, future studies should focus on identifying determinants with strong predictive power in order to develop a tailor-made and at the same time parsimonious model of ICT use in HE. Such evidence aids informed decision making and the development of well-versed policies pertinent to ICT integration in HE.

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