



# Instructors' educational ICT use in higher education in developing countries: evidence from three Ethiopian Universities

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Accepted: 28 March 2022 / Published online: 25 April 2022

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## Abstract

Developing countries exert much effort to improve the quality of their higher education. The use of information and communication technology (ICT) may address some of the quality problems in higher education in these countries. Previous studies on this topic stressed the impact of ICT use on learning, the status of ICT integration in education, and the factors associated with ICT integration with minimal attention to how instructors in higher education in developing countries use ICT. This study employed a qualitative approach, collecting data from twenty-one by then active instructors in three public universities in Ethiopia through focus group discussion to explore the educational use of ICT. The data were transcribed verbatim and analyzed thematically using ATLAS.ti software. The results show that instructors in the selected Ethiopian universities use ICT for course facilitation, course materials preparation, professional development, assessment, and information and resource exchange purposes. However, these findings do not reveal a transformative use of ICT in education, which may imply that ICT is not used in a manner that alters existing teacher-centered approaches. This study suggests that future studies may focus on why instructors rarely use ICT in a transformative way and developing a tailor-made and efficient model that informs practice.

**Keywords** ICT use · Higher education · Instructors · Ethiopia · Focus group

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## Introduction

The use of ICT<sup>1</sup> has brought profound changes in teaching and learning practices (Islam et al., 2019; Tiyar & Khoshshima, 2015). However, its impact on student learning outcomes is not clear (OECD, 2015). While some studies point out positive effects (e.g., Akinbadewa, 2020; Álvarez et al., 2013; Naji, 2017; Safar, 2015), others indicate that the use of ICT has brought no considerable improvement (e.g., OECD, 2015). Despite unclear research findings on the impact of ICT on learning outcomes, developing countries (DCs), where access to and quality of education are chronic problems, can be particular beneficiaries of ICT-mediated learning (Nawaz, 2013).

In Ethiopia, one of the least developed countries with a total population of 107.5 million (World Bank, 2018), a recent study by the Ministry of Education revealed that higher education (HE) suffers from a lack of quality education. This is mainly expressed in terms of graduates' low employability skills (MoE, 2017). The same study pointed out that HE is characterized by educational programs that are less relevant to the labor market demands, insufficient minimal learning and teaching resources, and outdated instructional teacher-centered approaches that hardly promote the implementation of much needed competency-based curricula. It seems DCs like Ethiopia could change existing problems with the quality of education by implementing a transformative use of ICT in HE (Kozma & Vota, 2014). This concept refers to the use of ICT to promote the application of student-centered teaching and learning approaches (Alemu, 2015). It is characterized by: (a) instructors being skillful in using different ICTs creatively and efficiently (Choeda et al., 2016) rather than using it to repackage the prevailing teacher-centered pedagogy, (b) making ICT use an integral part of teaching and a tool to link learning content to real-world applications (Teo, 2009) and (c) ICT use that is linked to learning goals (Mama & Hennessy, 2013). Scholars such as Alemu (2015) and Barakabitze et al. (2019) argue that the transformative use of ICT improves teaching and learning by promoting active, collaborative, and creative learning, and by enabling access to abundant teaching–learning resources. In addition, studies indicate that ICT promotes the development of learners' critical analysis, problem-solving, self-learning, and ICT skills (Khan & Setiawan, 2019). Cognizant of these and other benefits of ICT, HE institutions in DCs have continued to expand their infrastructure regardless of their poor economic situation (Barakabitze et al., 2019). However, it is not clear whether instructors in Ethiopian HE are using ICT in a way it transforms teaching and learning.

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<sup>1</sup> In this study, ICT relates to those technologies that are used for accessing, gathering, manipulating and presenting or communicating information. The technologies could include hardware (e.g. computers); software applications; and connectivity (e.g. access to the internet, local networking infrastructure, videoconferencing) (Christensson, 2010, p. 3). And ICT use refers to the adoption by instructors of these technologies to support teaching and learning practices.

## The research context

As with other countries, Ethiopia has its own context that might have implications on ICT use in HE. As a result of the massification of HE in Ethiopia, its quality seems to be compromised. In the Ethiopian HE sector, issues of access, relevance, equity and quality remain the major challenges that need to be addressed during the implementation period (2018–2030) of the current education development roadmap (MOE, 2017).

ICT is a relatively new phenomenon to Ethiopia (Alemu, 2017) and its penetration in the education sector is slow (Tibebu et al., 2009). The Ethiopian government has embarked on ICT-enabled transformation in all sectors, including education, to enhance performance and deliver better public service with the ultimate goal of improving the lives of its citizens (Lixi & Dahan, 2014). In its fifth Education Sector Development Program (ESDP V) 2015/2016–2019/2020 the government vows to commit itself to expanding ICT integration to transform the quality of teaching at all levels of education. In the plan, it is described that during the implementation period of ESDP V, ICT in education policy will be ratified, ICT and internet connection will be provided to all universities; pedagogy, technology, and content will be integrated; ICT will be mainstreamed across core subjects; digital contents will be developed, and a learning management system (LMS) will be in place at all levels of education to support the teaching and learning activities (MOE, 2016). With the postulation that the use of ICT is a key tool to address the multifaceted problems of Ethiopian HE, the government highlighted the need to transform the HE campus environments via ICT and engage in increased investment in ICT. There are several challenges to the use of ICT in Ethiopian HE. Studies indicate that a lack of institutional policy (Ergado, 2019; Tibebu et al., 2009), limited access to ICT infrastructure (Alemu, 2015; MOE, 2017; Tibebu et al., 2009) a deficiency of instructors' and students' ICT skills (Ergado, 2019; Tibebu et al., 2009), a lack of management and technical support (Alemu, 2015; Ergado, 2019; MOE, 2017; Tibebu et al., 2009), a shortage of time, a lack of incentives and instructors' resistance (Ergado, 2019) are the major challenges to ICT integration in Ethiopian HE.

## The research problem

Instructors' ICT use may range from occasional use to facilitate existing teaching and learning practices to a more advanced ICT integration level, which is strongly linked to pedagogical principles and learning objectives (Mama & Hennessy, 2013). The way instructors use ICT influences its impact on teaching and learning. For instance, Mama and Hennessy (2013) observed that ICT integration which is directly linked to lesson objectives, has a higher impact on pedagogical practices than the one delinked from learning objectives. This implies that how instructors use ICT influences its impact on teaching and learning and, hence, deserves attention in a study of ICT use in education.

Scholars have studied and characterized different uses of ICT in education (Baylor & Ritchie, 2002; Mama & Hennessy, 2013; Tondeur et al., 2007). These studies

mainly focused on primary and secondary schools and were conducted in developed countries. As a result, there is little evidence on how instructors in HE, particularly in DCs use ICT in a transformative way. The existing few studies in HE in DCs focus on examining the extent of ICT implementation and its barriers (Asuman & Clement, 2018; Kisanga & Ireson, 2015; Rana & Rana, 2020; Raphael & Mtebe, 2016; Tongkaw, 2013) with little attention to how instructors use ICT. The context of teaching and learning at the HE level is different from that of primary and secondary schools. For instance, teaching and learning in HE focuses not only on training future entrepreneurs but also on informing citizens who can accelerate democratization and socio-economic development processes (Van Deuren et al., 2016). In addition, HE prepares citizens to innovate and transfer technologies that may solve human problems (Lehmann et al., 2020). In this regard, HE contributes to building an inclusive and diverse knowledge society by equipping its citizens with twenty-first century skills (see Greiff et al., 2015). Furthermore, students in HE are expected to be critical thinkers and independent learners who need limited support from their instructors (George & Supreetha, 2021; Raman, 2016). Differences in ICT use practices may also be expected between instructors' in HE in developed and DCs based on the arguments that: (a) ICTs have largely their origin in developed countries to address educational problems there and are used in DCs without contextualization (Lubin, 2018), (b) ICT use initiatives in DCs are mainly donor driven (Barakabitze et al., 2019; Lubin, 2018) and (c) organizational culture in HE in DCs is hardly accustomed to ICT adoption (Njenga, 2018). Such differences in the context, purpose, and methods of teaching, as well as student profiles may affect how instructors use ICT.

### **The purpose of the study**

The current study started from the assumption that different milieus may imply differences in ICT deployment for educational purposes. However, given the shortage of studies about ICT use in DCs particularly in Ethiopia, we aim to improve our understanding of such contexts in relation to ICT use among HE instructors. In particular, this study explores in a qualitative manner how cohorts of Ethiopian instructors from three universities use ICT for educational purposes. The study's findings are expected to contribute significantly as they unravel for the first time, to our knowledge, the various patterns of and reasoning behind educational ICT usage by Ethiopian HE instructors.

### **Method**

This study employed a qualitative approach to explore university instructors' experiences with and opinions about their educational use of ICT in their particular context (Flick, 2018; Merriam, 2002). We opted for a qualitative approach to gather rich, in-depth information on *how* and *why* instructors use ICT for educational purposes (Ary et al., 2018).

## Selection of participants

Data were collected from instructors working at three universities. These universities represent different categories of institutions. The first is labeled as ‘mature’, referring to universities that were established between 1950 and 2000, and expected to have relatively (with compared to emerging and new universities) adequate ICT infrastructure, high-qualified instructors, and student enrollment numbers (undergraduate and postgraduate) that range between 20,000 and more than 43,000. The second category (‘emerging’) refers to universities that were established between 2006 and 2009, with enrollment rates between 3,333 and 15,000. The ‘new’ universities, a third category, were established between 2010 and 2011, have fewer students and focus mainly on undergraduate programs (Geda, 2014). One university from each category was selected in a purposeful manner. Next, a few instructors from each university contacted and asked to recommend two to three instructors (per faculty) who could participate in the study. If an instructor from a particular faculty or college showed interest to participate, the study’s purposes were explained in greater detail. Afterward, an instructor from another faculty or college was contacted. If the person that was met first did not show further interest, a new instructor from the same faculty or college was contacted. This procedure was repeated until we secured that at least one instructor from each faculty or college from the three universities participated. As a result of this snowball sampling method, 21 instructors have retained as focus group (FG) members. They had various disciplinary backgrounds (Health, Social Sciences, Natural Sciences, Engineering, Agriculture, and Business and Economics) and between 2 and 20 years of teaching experience. More details regarding the profile of the participants can be found in “Appendix 1” section.

## Data collection

Data were collected through discussions in FGs. The researchers opted for a FG as it is an effective method for sharing ICT use perspectives by instructors with diversified backgrounds and experiences (Creswell, 2012; Dilshad & Latif, 2013). FG use enables the collection of convergent and divergent views and allows that individual participants’ opinions are restructured as a consequence of mutual influences (Flick, 2018). Moreover, particular ideas may occur spontaneously during the conversations. In other words, a FG holds the potential of revealing themes that might be forgotten when interviewing instructors individually (Dilshad & Latif, 2013).

One FG was organized per university. All three FGs were conducted face-to-face in a convenient room permitted by the universities and agreed by the participants. Their duration ranged from 90 to 110 min. Prior to the study, all participants were informed about the purpose of the study and the processing of the results. Their participation was voluntary and without compensation. At any moment they could withdraw from the study. Each of the participants signed an informed consent document, as provided by the university ethics regulations. The principal researcher facilitated

all three FGs. The discussions were introduced by the question “For which educational purpose do you use ICT?” followed by probing questions such as “How do you use ICT in the classroom? How do you support your teaching with ICT? For what educational purposes do you use ICT outside the classroom?”.

All FGs were audio recorded and stored on a computer. The principal researcher transcribed the entire recordings verbatim into regular text files. The parts of conversations in a local language were transcribed and translated into English. The members' checking technique was employed to ensure the study's trustworthiness; the principal researcher sent full transcripts to the participants to have checked whether what they had said during a FG was correctly transcribed (Shenton, 2004; Yin, 2009). More than half of the respondents gave feedback; all confirmed the correctness of the transcriptions.

## Data analysis

Creswell's (2012) six steps of qualitative data analysis were applied. The coding, segmentation, merging and formation of themes were performed using ATLAS.ti qualitative data analysis software. The principal researcher and one co-researcher developed a codebook and coded the first FG dataset together. Afterward, the principal researcher finalized the coding of the remaining two FGs using the agreed codebook. Data are linked to themes at different levels (three in total) based on similarities and commonalities in their meaning. Hence, the findings are organized in such a way that instantiations are sorted out and analyzed in detail. A figure is created, which represents graphically the thematic network of the emerging themes and sub-themes. These were derived inductively, as previously noted. Descriptions of the themes are supported by their appearance in the transcriptions. Examples of quotations are provided for illustration in the tables corresponding to each theme in the Results section.

## Results

As depicted in Fig. 1, from the evidence emerged fourteen basic themes grouped under five organizing themes. A summary of all findings regarding ICT use of instructors in each of the three universities can be found in “Appendix 2” section. In this, the universities are labeled by pseudo names ‘A’, ‘B’ and ‘C’ while the participants are represented by numbers to preserve their anonymity. When participants' reflections were very similar, the most representative quote was selected. Square brackets indicate that a part of the transcript has been omitted in order to concentrate on what is key for illustrating the findings.

In what follows, we describe the organizing and basic themes. These are: (1) *course facilitation* consisting of displaying, demonstration, and using presentation slides; (2) *material preparation and storage* including lecture note preparation, presentation slides preparation, books and storage; (3) *professional development* comprising self-development and scholastic activities; (4) *assessment* encompassing

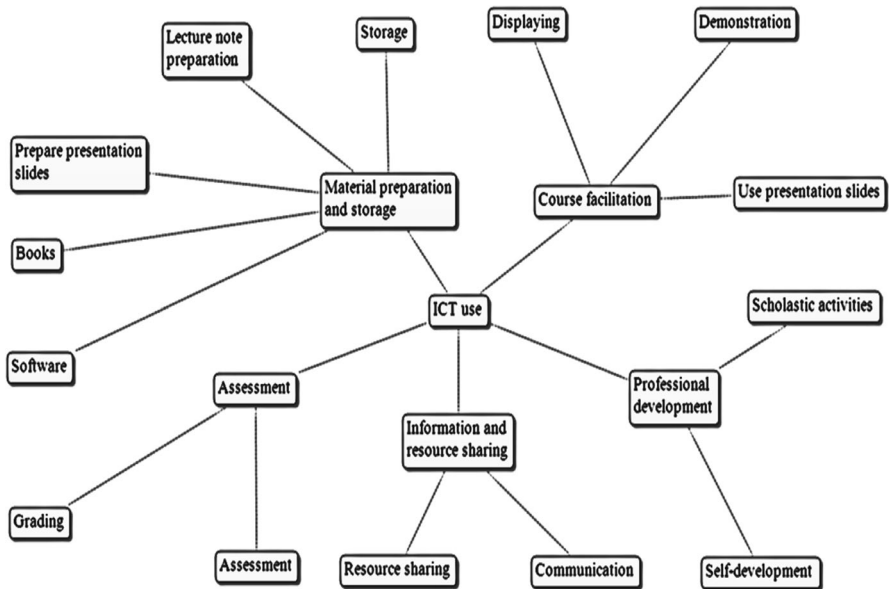


Fig. 1 Thematic network of the emerging themes

grading and assessment and (5) *information and resource exchange* consisting of communication and resource sharing.

## Course facilitation

Course facilitation refers to the use of ICT to facilitate course activities in the classroom. It involves instructors' use of computers, internet, intranet, and beamers in the classroom to *display visualizations demonstrate procedures* and *presentation slides* (see Table 1).

*Presentation slides* are one of the purposes for which instructors use ICT in the classroom. It refers to using slides to flash texts and facilitate classroom lectures simply. Instructors prefer to use presentation slides in the classroom as it allows them to cover bulky lessons within a shorter time.

*Displaying* refers to the use of ICT to flash illustrations for students in the classroom. The instructors stated that they frequently use the internet, computers, and LCDs to portray pictures, images and visualizations that help students easily understand new and abstract concepts. The instructors also use ICT to show their students what awaits them (state-of-the-art technologies) in the real world of work so that learning becomes authentic.

It was also learned that instructors use ICT for the purpose of supporting classroom instruction through *demonstrations*. The participants reflected that they use ICT to demonstrate various experiments and procedures that cannot be carried out in the actual classroom or in the laboratory due to, e.g. shortage of resources. As

**Table 1** ICT use for course facilitation

Basic theme	Frequency	Example of quotation
Use presentation slides	19 (90%)	A5: I use computers for the purpose of delivering class through PowerPoint [...]. It allows us to manage our class because we are not expected to write on the blackboard. "C6:" We use computer during teaching-learning especially LCD/or power point preparation
Display	18 (86%)	A2: Visualization makes the lesson more understandable [...] it is difficult to explain what glucose is and its molecules, but with computer aid, it is easy for students to understand B5: We have to use computer and the internet frequently as most of our subjects need visualization or displays of depictions
Demonstration	7 (33%)	C6: We use ICT to demonstrate some lab activities and procedures, for example, testing certain concentration A6: while teaching of GIS course, [...] I demonstrate weather forecast and temperature. This makes teaching and learning process efficient and very understandable to students C4: we use videos and animations to make the lesson more concrete and this demands the use of ICT [...]. In the lab we have deficiencies of equipment and other resources to conduct experiments



said by instructors, demonstration enables the concretization of ideas and processes so that students can easily understand the lesson.

### Preparation and storage of teaching materials

The instructors reported five different themes regarding teaching materials that they (and their students) use to reach course objectives. It regards searching, compiling, writing, organizing, and storing teaching resources such as electronic books, videos, presentation slides, and readers (handouts). This type of educational use of ICT is mainly performed outside classrooms as a part of the preparation for classroom instruction. Instructors in the three universities comparably use the internet and computers to prepare, organize and store multimedia resources such as texts, videos and animations that support teaching and learning. The basic themes under the preparation and storage of teaching materials category and their respective examples of quotations are presented in Table 2. According to the participants, instructors use ICT to prepare *lecture notes* that consist of key points of the lesson to be used by the students. The instructors reflected that they use ICT to prepare notes or handouts mainly for the theoretical parts of the courses to support classroom presentations so that students can read them before class. In addition, instructors use ICT to *prepare presentation slides* for classroom lectures.

Apart from the preparation of teaching materials, the instructors use ICT, particularly the internet, to search for *books* they and their students can use as a resource. According to the participants, adequate and up-to-date books are hardly available in hard copy in their libraries. Hence, they use the internet to search for books in soft copy. The instructors attach the advantages of portability, storage, and easy retrieval to the use of electronic books. Instructors also use ICT to search for *software* that they can use for educational purposes. According to the participants, ICT, mainly the internet, is a vital source for searching educational software such as AUTO-CAD, GIS, IRIDAS, SPSS, and SAS, which support practical lessons in and outside classrooms.

Furthermore, instructors use ICT for *storage* purposes. Storage refers to the use of ICT by instructors to create a repository of teaching resources. The instructors reflected that they use ICT to create a personal digital library for the different courses they teach and to keep a record of students' data. The instructors use ICT for storing huge amounts of data which would be difficult to do otherwise.

### Assessment

Assessing students' learning progress is another purpose for which instructors use ICT. It comprises of ICT use for grading and assessment purposes (see Table 3).

The participating instructors use ICT for *grading* purposes. Participants indicated that they use ICT for processing and submitting students' grades online. In the three universities, there is an online grading system that instructors use to submit students' grades. Using an online grading system enables instructors to become more

**Table 2** ICT use for materials preparation and storage

Basic theme	Frequency	Example of quotations
Lecture notes	18 (86%)	<i>B5:</i> For the lecture part we use ICT to prepare different notes or handouts for the students <i>A7:</i> we use ICT for preparation of teaching materials, lecture notes
Prepare presentation slides	17 (81%)	<i>C6:</i> We use ICT particularly computers to prepare PowerPoint for classroom lectures and presentations <i>A3:</i> Also we use computers for the preparation of lesson materials, like PowerPoint
Books	15 (71%)	<i>A6:</i> [...] I browse different books in order to support my lesson <i>B5:</i> I use ICT to download latest books that are related to my courses <i>C1:</i> The other one is unavailability of books. If hard copy books are available in the library in the required amount I may not use ICT that much
Software	6 (29%)	<i>C6:</i> ...different analysis and designs in engineering demands us to run various software. We download this software from the internet
Storage	4 (19%)	<i>A3:</i> I am using these materials (computers) to store huge amount of data and teaching <i>B4:</i> storage of teaching resources in hardcopy takes much physical space but in softcopy storage of videos and texts on one's computer takes very little space

**Table 3** ICT use for assessment

Basic theme	Frequency	Example of quotations
Grading	19 (90%)	<i>C4</i> : ... we have started submitting students' grades using online systems <i>B4</i> : Here in our university we have online grading system. This grading system saved us from many paper works that takes us long time to process students' grade manually
Assessment	4 (19%)	<i>B5</i> : Another use of ICT is for processing students' learning assessment data [...].we collect and store data regarding students' progressive assessment <i>C/1</i> I also use computer to prepare exams and tests for the students and my own preparation

**Table 4** ICT use for professional development

Basic theme	Frequency	Example of quotations
Self-development	12 (57%)	<p>A4: ...I feel I have to update myself as a teacher [...] I feel updated when I read something on internet or when I use my computer for searching information</p> <p>C2: We use ICT in order to gain new insight or to gain new concepts for what we are going to teach the students</p> <p>B1: ...But teachers need to train themselves by watching different videos online</p>
Scholastic activities	8 (38%)	<p>C7: ... we use ICT to search and collect resources for research undertaking</p> <p>A7: Without ICT it is difficult to conduct research</p>

efficient, i.e., it enables them to process grades quickly and reduce errors they may make when doing it manually.

In addition, the participants stated that they use ICT to *assess* and record data regarding the students' learning process. This comprises the use of ICT for preparing examinations and analyzing and submitting students' grades. The participants also mentioned that they use computers to write exams and assignments for students. Most of the learning assessment activities in the three universities are supported with ICT.

### Professional development

Professional development refers to using ICT by instructors to improve their professional knowledge, skills, and expertise. As depicted in Table 4, it encompasses *self-development* and *scholastic activities*. Unlike professional development interventions that universities organize, *self-development* refers to a type of professional development in which instructors themselves take the initiative. It involves instructors' use of ICT to remain up-to-date with contemporary developments in their respective fields of study. The participants perceive that they need to stay abreast professionally and that, for this reason, they use ICT as a tool to access relevant resources. This implies that ICT has become a crucial instrument for instructors to keep themselves informed about developments regarding the subjects they teach and the pedagogy they adopt.

*Scholastic activities* refer to the use of ICT by instructors for research activities, including literature search and research findings dissemination. It is considered a professional development activity because when instructors are involved in individual and collaborative research areas of their professional interest, they develop professional expertise. The participants discussed that ICT, particularly the internet, is an irreplaceable resource of information for instructors to be involved in scholastic activities (search literature, identify appropriate journals for publication).

Besides looking for scientific resources, instructors also use ICT to share their research findings with others. Instructors mostly publish their research findings in open access journals so that they are accessible without fees. This implies that

**Table 5** ICT use for information and resource exchange

Basic theme	Frequency	Example of quotations
Communication	10 (48%)	<p><i>B8</i>: ... We have institutional e-mail which we use for any official communication. Using e-mail has replaced previous paper based communication</p> <p><i>C7</i>: If I do not have materials in hard copy on what I teach I can receive the necessary resources from colleagues teaching in other universities like Jimma and Wollega universities through e-mail</p>
Resource sharing	8 (38%)	<p><i>A2</i> In our department we do have a shared Google account where we usually upload certain materials and colleagues could download and use those materials</p> <p><i>C4</i>: The other one is material sharing. In our department, we have made digital resources to be stored in one place and used by all teachers and students for teaching and learning purpose</p>

research undertaking is linked to the instructors' regular task of teaching and the role of ICT is crucial in facilitating instructors' involvement in research. The internet in particular is a major source of input (e.g., journal articles) required for developing research proposals and disseminating research findings to the scientific community and other beneficiaries.

### Information and resource exchange

This category refers to exchanging information and sharing resources between instructors and students, and among instructors themselves on matters pertinent to courses they teach. As shown in Table 5, it comprises *communication* and *resource sharing*. From the FGs it was learned that instructors use ICT for the purpose of *communication* as well. The participants indicated that e-mail is a predominant means of communication among instructors and students on education matters.

In addition to the use of ICT for communication purposes, the instructors stated that they use ICT for *sharing* teaching and learning resources among colleagues. For example, the participants mentioned that they create group accounts in Google and Microsoft and share various course materials that can be used for teaching. There is also evidence from the discussions that instructors use LMS like MOODLE to share resources with the students.

## Discussion

Instructors' educational use of ICT is driven by the university's focus on improved access to digital (online) resources and fair use of technology. Their usage may include course materials preparation and storage, course facilitation, assessment, professional development, and information exchange and resource sharing. This usage is consistent with the findings of van Braak et al. (2004) that label teachers' main ICT use as supportive and classroom use. Supportive use of ICT includes the use of ICT for student evaluation, preparing supplementary reading materials, and keeping track of pupils' learning progress, whereas ICT use for such things as a demonstration, drill and practice, instruction, and differentiation refers to classroom use of ICT (van Braak et al., 2004). The basic themes belonging to *course facilitation* conceptually fit into the *classroom use* of ICT proposed by van Braak et al. (2004) as they both refer to the use of ICT for similar purposes (e.g., flashing information in the classrooms using beamers). We argue that *course facilitation* is more appropriate as a theme than *classroom ICT use* when it comes to the educational use of ICT because *classroom use* denotes more of where to use ICT while *course facilitation* focuses more on the specific purpose for which ICT is used in teaching and learning. In addition, the basic themes *material preparation* and *assessment* conceptually coincide with supportive ICT use of van Braak et al. (2004). Compared to van Braak et al. (2004) classification, ours is broader as it adds the *professional development* and *information and resource sharing* themes that are not a part of van Braak et al. (2004) ICT use classification. Also, Meneses et al. (2012) classify ICT use as supportive and managerial use. Managerial use of ICT refers to ICT use for communication and interaction whereas supportive internet use refers to using the internet to prepare course materials that support classroom instruction (Meneses et al., 2012). Our classification of ICT use also overlaps with Meneses et al.'s (2012) classification in that the *material preparation* and *assessment* themes that emerged from our study conceptually fit into supportive ICT use of Meneses et al. (2012). In addition, the *information and resource sharing* theme emerged from our study partially fit into managerial ICT use proposed by Meneses et al. (2012) as both involve the use of ICT for information and resource exchange. However, we extended this category by including the use of ICT for resource sharing. Also, compared to Meneses et al. (2012) ICT use classification, ours is broader as it extends their classification by adding the *course facilitation* and *professional development* elements.

*Supportive ICT* use, as coined by van Braak et al. (2004) and Meneses et al. (2012) is a very broad concept and includes several distinctive educational uses of ICT outside the classroom, including material preparation, professional development and assessment, which are emerging as independent organizing themes in our study. As we claimed in the result part, these themes have their own distinctive characteristics and hence need not to be put in one basket (supportive ICT use). For example, using ICT for *material preparation* and *professional development* are different functions when seen from teaching and learning perspective. The former focuses on organizing teaching and learning tools so that students can

learn from the materials at any time without much dependence on the instructors. The latter involves what the instructors actually perform with ICT to keep themselves updated with recent development in the areas of pedagogy, technology, and content of subjects they teach. The concept of *supportive ICT use*, thus, is vast and less informative as ICT is generally used as a supportive tool in all forms of its use in teaching and learning.

In sum, this study's evidence supports findings of previous studies (e.g., Meneses et al., 2012; Ricardo-Barreto et al., 2020; Van Braak et al., 2004). Furthermore, the study's findings extend previous ICT use classifications by adding *professional development* and *assessment* elements. Our ICT use classification is, thus, more systematic (we recognized the distinctive features of educational ICT use) and comprehensive (we extended ICT use classification by previous studies).

From the analysis, substantial evidence was generated that support the notion that instructors predominantly use ICT to support the existing teacher-centered classroom practices. In the three universities studied, the sampled instructors stated that they usually use presentation slides to facilitate teaching–learning practices, particularly classroom lectures. They seem to incline towards emergent users. This means they use ICT in the way it brings no substantial change in teaching and learning compared to the non-users (Choeda et al., 2016). This finding corroborates findings of studies in HE in some developed countries such as Japan (Aoki, 2010) and Germany (Bond et al., 2018) where ICT in general and E-learning in particular, are used to support the prevailing teacher-centered classroom practices rather than to transform teaching and learning. A number of scholars discovered the same finding in countries such as Belgium and proposed actions for transformation (e.g. Goeman, 2008). However, transformative ICT use is yet to be realized. Moreover, the comparable use of ICT by instructors in the three universities implies that generational differences between Ethiopian universities (year of establishment, university size, and infrastructure) have no substantial impact on how they use ICT.

In general, we explored various educational ICT uses that supplement each other and ultimately facilitate the attainment of goals in teaching and learning. *Adequate preparation*, which is fundamental for instructors' effective classroom performance, is contingent upon the extent to which instructors have access to various multimedia resources. Whetten (2007) stated that a well-designed course demands adequate preparation. As described earlier, ICT is a crucial tool for preparing teaching resources at universities. Moreover, *students' assessment*, which is an integral part of learning-centered course design (see Whetten, 2007) is another aspect of educational use of ICT as reported by the participant instructors.

Furthermore, *communication* between students and instructors plays a pivotal role in learning achievement (Ndongko & Agu, 2014) and the use of ICT enables efficient communication. Teachers' collaboration in the form of resources and experience sharing positively influences their teaching performance as it allows them to work together to solve educational problems they encounter (Murray, 2010; Shakenova, 2017). The use of ICT assists electronic collaboration among teachers (one strategy of *professional development*). Self-initiated *professional development* activities in which instructors assume major responsibility for their own professional empowerment are also crucial to improve their pedagogical

skills (Simegn, 2014). As reported by the participants, ICT is a key tool by which instructors keep themselves updated with recent developments. Besides, developing a personal *repository of course resources* allows instructors to retrieve and use electronic resources when needed easily. It also allows efficient sharing of resources among instructors. As reported by the participants, instructors use ICT as it enables effective and efficient storage of e-resources that can help them to support classroom instruction. It is, therefore, evident in this study that ICT is used to accomplish various teaching–learning activities in universities under scrutiny.

## Conclusion

The results from this study indicate that instructors in the participating universities use ICT primarily to support the existing teacher-centered pedagogy in a non-transformative way. ICT use in these universities hardly facilitates active, collaborative and creative learning, which are considered to contribute to improved HE quality. Contrary to what was expected, this study's findings are similar to what was supported about educational ICT use at universities in some developed countries (e.g. Goeman, 2008). This comparability of ICT use patterns at universities in developed and DCs might imply that differences in the level of economic development do not necessarily lead to differences in the status of affairs or the advancement of educational ICT usage in HE.

One might conclude that ICT usage in Ethiopian HE mimics to address educational problems that are observed in developed countries, independently from (considerations about) the DC context. Future studies could, therefore, focus on an integrated examination of national, institutional, curricular and didactic elements to ensure contextualized and transformative use of ICT. This may involve the investigation of critical conditions and pre-conditions for transformative ICT use and the development of a customized model that informs such an ICT use practice in DCs. The classification of ICT usage that is presented in this study may aid in this regard.

## Appendix 1

Profile of the participants.

		Frequency	Percentage
Level of education	Bachelor Degree	1	4.8%
	Master's Degree	18	85.7
	PhD	2	9.5%



		Frequency	Percentage
Academic rank	Lecturer	15	71.4%
	Assistant Professor	6	28.6%
	Associate Professor	0	–
	Professor	0	–
Service year	0–5	10	47.6%
	6–10	8	38%
	11–15	2	9.5%
	20 and above	1	4.8%

## Appendix 2

Summary of instructors' educational ICT use in the three universities.

Organizing themes	University A	University B	University C
Course facilitation	Demonstration in a classroom, display information and deliver class through presentation slides	Classroom presentation using PowerPoint, display and demonstrate various lessons, visualize illustrations, and display pictures	(Video or visual aids) for classroom instruction, classroom presentation and facilitation, display different pictures and animations, demonstrate lab activities, and analysis and designs in engineering
Material preparation and storage	Preparation of lecture note, storage of data, download educational software, prepare lesson materials (in excel, word etc.), search additional information pertinent to courses they teach and download books	Preparation of handouts and lecture notes, different information pertinent to course they teach, store learning assessment data, preparation of presentation slides, access and assemble teaching resources, download software applications and books	preparation of teaching materials, handout, lesson plan, presentation slides, software and searching different electronic books online
Assessment	Preparation of grade and submit final results of students via SRS (registration software)	Collection and processing of learning assessment data-continuous assessment record and keep students' assessment data on SRS	feeding and submitting students grades online using SRS,

Organizing themes	University A	University B	University C
Professional development	Research undertaking, update own self with recent developments, disseminate research findings-publications, self-learning through YouTube	gaining new insights through internet, searching new information regarding courses they teach and updating themselves academically	Updating themselves with emerging innovation, developing own capacity through online self-learning, collecting resources for research undertaking,
Information and resource sharing	Dissemination of teaching and learning resources to students, putting resources on learning platform for students, share teaching resources through Google account	Communicating with students and teachers in and outside the university	communicating with students and teachers, assignment of students on course activities, sharing digital teaching resources, sharing resources with colleagues in other universities

**Funding** This study was supported by Jimma University (Ethiopia) and KU Leuven (Belgium).

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