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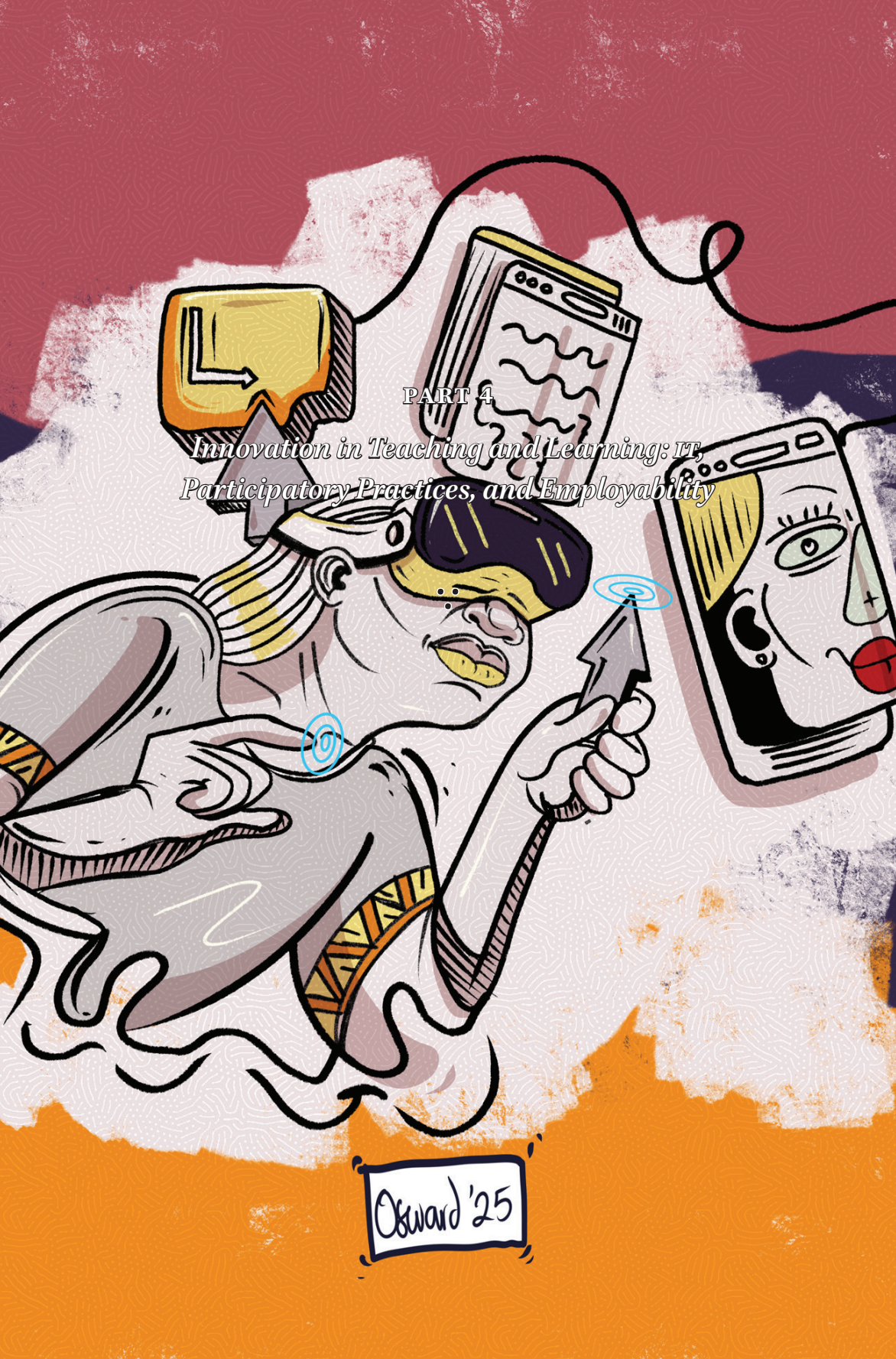

PART 4

Innovation in Teaching and Learning: IT, Participatory Practices, and Employability

CHAPTER 11

Advances toward Digital Learning

A Scoping Review of Research and Practices from East Africa

Ann Bygholm, Lone Dirckinck-Holmfeld and Geoffrey Olok Tabo

Abstract

The aim of this scoping review is to identify the extent and nature of the use of digital technologies and new pedagogies In East African higher education. That is, which technologies are in use, how are they used and how is the relation between student-centred pedagogies and digital technologies described and accounted for. The review covers the period from 2009 to 2024. Three main areas appeared from the analysis: professional development, supporting the digital learning process, and community learning. Within professional development emphasis is on context specific approaches and institutional support; the papers on supporting the digital learning process stress the importance of addressing technological barriers, enhancing resource sharing and adapting pedagogical strategies to improve educational practice, and papers from the community learning category illustrate innovative approaches to education and community engagement. The analysis also revealed that the use of mobile phones and Moodle is widespread, that the main use is for sharing of content such as course outlines, slides and readings, and that there is a general agreement that use of digital technologies promote collaboration, self-regulated and student-centred learning. Cross-cutting challenges were identified, and implications of our findings for practice and policies are discussed.

Keywords

transforming education – scoping review – higher education – student-centred pedagogies – digital learning

1 Introduction

It is generally acknowledged that education is an important factor in fostering innovation and economic growth, also in Africa. But the role of higher education in this process has been disputed. Previously, in the 1980s and 1990s, it

was assumed that educational efforts should focus on primary education and partly also secondary education, as the return rate from these investments was assumed to be much better than from higher education. The reason for these assumptions and the related decline in funding to higher education from The World Bank and other important economic actors is explained by e.g., Hayward and Ncayiyana (2014) and Bloom et al. (2014). However, in the beginning of the 21st century, a more balanced view on the role of higher education gained foothold, and higher education is now accepted as central for economic growth as well as for political and social development, also by funding institutions.

Bloom et al.'s (2006) analysis of the impact of higher education in Sub-Saharan Africa led them to conclude that expanding higher education 'may be important in promoting faster technological catch-up and improving a country's ability to maximise its economic output' (p. 36). A similar conclusion is made in Bloom et al. (2014) and Gyimah-Brempong et al. (2006), based on data (from 1960–2000) from 34 African countries, arguing that especially higher education 'has a relatively large and statistically significant effect on the growth rate of per capita income' (p. 525). Bloom et al. (2006) mention that the many differences between the countries involved in the study e.g., in policy environment, should be considered and that these differences may affect economic growth. Also, it is noted by Gyimah-Brempong et al. (2006) that the estimates do not account for e.g., 'growth loss' due to emigration of highly educated Africans, and many other obstacles in achieving the said effect.

Focusing more specifically on East Africa, the East African Community Vision 2050 and the East African Development Strategy 2021/22–2025/26 also emphasise education, in general, as a key enabler for development. The Vision 2050 paper outlines the overall ambition 'for the region to enhance transformation for growth and development and move the community to higher income cohort and subsequently achieving an upper middle-income status', (p. 12) and points to the need for development in all areas of society (infrastructure, energy and IT, industrialization, agricultural and rural development). This calls for a well-educated and healthy population in the region. As for education the focus of Vision 2050 will be particularly on improving access to and completion rates at higher levels (p. 95). Furthermore, a University of the Future is outlined where the university's traditional tasks, teaching, research, and community service remain but the content changes. Thus, for example it is anticipated within teaching that the focus will change from teacher centred to student centred approaches, within research that the aim of finding practical solution to problems in the local communities will gain prominence, and within community service that universities work closely with the surrounding society to produce graduates that fulfil the need of the private sector, government, local

communities etc. Also, information technology plays an important role in the University of the Future e.g. (Vision 2050, Annex 3, p. 136).

The East African development strategy (2021/22–2025/26) identifies more specific objectives to be achieved in the five-year period. Objectives that are in alignment with both the Vision 2050 paper and the individual participating states' own vision statements. And again, the need for investment and reforms around human capital, including education, training, and health, is underlined as important. It is stated that, despite positive trends, the region is characterised by several challenges such as high poverty rates and unemployment, and that the labour force on the one hand will need further skills to be turned into a productive resource, and that the employment base on the other hand is too narrow to absorb the existing labour force. In the strategy paper from 2016/17–2020/21 the specific interventions regarding education included establishing a system for quality insurance and harmonisation of educational systems in East Africa, support of regional Centres of Excellence, and the introduction of e-learning. The newest strategy paper adds emphasis on the need for linking higher education with industry and remodelling the curricula to create critical and creative thinkers to fit in an ICT intensive society (EAC, 2021, p. 107).

As for more specific initiatives and intervention in higher education this is taken care of by the Inter-University Council of East Africa (IUCEA), who also have published strategic plans since 2006, the latest is covering the period 2021/22–2025/26. IUCEA has existed in some form since the first independent universities were established in 1970 in Uganda, Tanzania, and Kenya. The collaboration was more formally confirmed as responsible for coordinating higher education in 2002, and in 2007 Burundi and Rwanda joined IUCEA, later South Sudan also became a member. The aim of IUCEA is to facilitate higher learning institutions in EAC to reach a transformative, inclusive and equitable quality education for all. It is stated that

> Focusing on digitization of learning and teaching, research and innovation and community engagement in higher learning institutions will lead to economic integration and private sector development, tallying with the need of a growing community. (IUCEA, 2021, p. VII)

Six objectives are formulated, including establishing university leadership training programmes, establishing regional information hubs for integrated higher education, and advocating for a digital learning infrastructure to enhance quality and innovation of instruction in higher learning institutions. Several challenges for higher education in East Africa are identified e.g., the exponential growth in enrolment without a corresponding growth in

funding with the danger of lower quality as a result, low quantity and quality of research and research not translated into innovation, and a general weak connection between academic, public sector, private sector, and civil society (IUCEA, 2021, pp. VIII–IX).

Overall, ambitions for higher education in East Africa are high, vision and strategies are formulated, systems to support the strategies are maturing, and challenges are numerous. Universities are slowly moving to adopt new pedagogies such as PBL, digital learning, hybrid learning, student centred learning, blended learning, and participatory approaches in the strive to improve quality to respond to the many challenges experienced by the East African universities, i.e. the growing number of students, poor infrastructure and facilities, lack of funding, and employability. There are, however, limited studies synthesising practice and experiences in implementing these pedagogical changes. In this paper we review the literature on how East African universities cope with these challenges, how they experiment with the use of technology, student centred pedagogies, and the organisation of educational activities.

2 Methods and Material

The review was carried out as a scoping review. Arksey and O'Malley (2005), who published the first methodological guide for scoping reviews, points to four different reasons for conducting a scoping review instead of a systematic literature review. The first one being to examine the extent, range and nature of a research activity, not to describe the findings in any detail but more to map the field and visualise the range of material that might be available. The second reason is to do a scoping review as a pre-study to a systematic review, and the third is to summarise and disseminate research findings to e.g. policy makers and practitioners. Finally, the fourth reason is to identify research gaps in existing literature. Peters et al. (2020) in an updated methodological guide for conducting scoping reviews, mentions along the same line six points: (1) as a precursor to a systematic review; (2) to identify the types of evidence available in a given field; (3) to identify and analyse knowledge gaps; (4) to clarify key concepts and definitions in the literature; (5) to examine how research is conducted on a certain topic or field; (6) to identify key characteristics or factors related to a concept (Peters et al., 2020, p. 2122). In our review we focus on how institutions within higher education in East Africa experiment with pedagogical innovation with digital technology, that is we want to examine the extent, range and nature of research within this area, how research is conducted, and how this in turn can inform policy and practice.

The review consists of two searches, using the same search terms and databases, one covering the period from 2009 to 2017 and another from 2018 to March 2024. Together the searches represent both the period before and after the Covid-19 pandemic. Thus, it is interesting to explore how the pandemic affected pedagogical innovation with technology. The databases used were ProQuest and EBSCOhost both representing collections of databases, together covering a very broad field of research output. The search in the databases were performed using strings of Problem-based Learning OR project-based learning OR blended learning OR e-learning OR mobile learning AND Participatory methods (OR variation hereof), AND Innovation (OR variation hereof) AND East Africa (OR the individual countries), AND Higher education (or variation hereof). The first search gave 132 results (ProQuest 95, EBSCOhost 37), and the second search 154 results (ProQuest 118, EBSCOhost 36). Going through abstracts removing papers from the health care area, papers focusing only on South Africa, papers not addressing higher education, not addressing pedagogical experiments, and redundant papers, 68 papers were examined more closely in the first search and 80 in the second search. Finally, 30 papers were included in the review (12 from the first search and 18 from the second).

All papers examine the use of digital learning in educational activities in East Africa, and all papers include some form of empirical studies. 13 papers are based on empirical data from Tanzania, 7 from Uganda, 6 from Kenya, 4 papers are based on data from Kenya and countries outside East Africa. The data presented in the papers were collected in a variety of ways including interviews, observation, workshops, experiments, scenarios, questionnaires, randomised studies, anecdotes (backed up by research diaries, project reports, meeting minutes etc.) and log data. The amount of data also varies widely.

3 Findings

Going through the papers we identified three main areas addressed in the papers related to pedagogical innovation and use of digital learning. The main areas are professional development (5 papers in the first search and 5 papers in the second search), supporting the digital learning process (4 papers in the first search and 11 papers in the second search), and community learning (3 papers in the first search and 2 papers in the second search). Below we first present the papers organised in these areas, then we sum up the main findings concerning use of technologies and pedagogical implications, and finally we identify some cross cutting challenges.

TABLE 11.1 Overview papers

Papers search 1	Main issue	Data collected	Country
Kemppainen et al. (2012)	Professional development – technology transfer	Personal experience in curriculum development (research diaries, project reports, e-mail etc.)	Tanzania
Onguko et al. (2013)	Professional development – reflections on blended learning	Interviews, observations – 12 participants	Kenya
Onguko (2014)	Professional development – challenging educational contexts	Interviews (follow-up) – 10 participants	Kenya
Foley & Masingila (2014)	Professional development – large classes	Workshops, questionnaires (10 responses)	Kenya
Tondeur et al. (2016)	Professional development – challenges in e-learning	4 cases (representing different contexts)	Kenya, Australia, Israel, Sri Lanka
Muyinda et al. (2010)	Digital learning process – mobile learning, learning objects	Scenarios	Uganda
Muyinda et al. (2011)	Digital learning process – mobile learning, learning objects	Questionnaire – 446 participants	Uganda
Muganda et al. (2016)	Digital learning process – open educational resources	Workshops with key persons (10), questionnaires (23 respondents)	Tanzania
Msonde & Van Aalst (2017)	Digital learning process – effectiveness of e-learning	Randomized study, 102 participants	Tanzania
Roy et al. (2012)	Community learning – responsible citizens, forest fire	Design experiments – questionnaires, 176 participants	Tanzania
Jobe & Hansson (2014)	Community learning – human rights	Log data from Moodle, 160 participants, 19 answers to course evaluation form	Kenya
Sanga et al. (2016)	Community learning – informal learning among farmers	Workshop, experiment with prototype, 19 participants	Tanzania

(*cont.*)

TABLE 11.1 Overview papers (*cont.*)

Papers search 2	Main issue	Data collected	Country
Almas et al. (2021)	Professional development – teachers use of e-leaning system	Questionnaire, 42 instructors participated	Tanzania
Bariu & Chun (2022)	Professional development - teacher's attitude, effects on implementation	Questionnaire, 475 teachers participated	Kenya
Loyola-Hernández et al. (2022)	Professional development - teachers' response to Covid-19	Mainly autoethnographic	Kenya (Mexico, United Kingdom)
Goshtasbpour et al. (2022)	Professional development - use of open educational resources	Authors critical reflections (based on meeting notes, email conversations, learner activity, post-course survey responses)	Kenya
Anasel & Swai (2023)	Professional development - factors hindering adoption of online teaching	Mixed method Questionnaire including both closed and open-ended questions – 177 answered	Tanzania
Ghasia et al. (2018)	Digital learning process - stakeholders' perception of m-learning	Qualitative interviews with teachers, students and ICT experts (25 teachers, 53 students, 6 ICT experts)	Tanzania
Bagarukayo (2018)	Digital learning process – use of Facebook to apply operating system knowledge	Questionnaire after the course, 48 students responded	Uganda
Ghasia et al. (2020)	Digital learning process - approach to e-learning since 2009	Documents, extracts from Moodle between 2010 and 2018 + policy documents	Tanzania
Mwandosya & Mbise (2019)	Digital learning process - pedagogical impact of the CBEMET prototype	Interviews and questionnaires, 40 teachers and 160 students from one campus participated.	Tanzania
Pete & Soko (2020)	Digital learning process - online learning during Covid-19	Questionnaire, 2341 responded, 842 from Kenya	Kenya, Ghana, South Africa

(*cont.*)

TABLE 11.1 Overview papers (*cont.*)

Papers search 2	Main issue	Data collected	Country
Namirembe & Kyobe (2021)	Digital learning process – factors influencing the uptake of e-learning)	Questionnaire, 184 students from two universities participated.	Uganda
Mwandosya et al. (2022)	Digital learning process - pedagogical impact of the CBEMET prototype	Interviews and questionnaires, 40 teachers, 542 students 8 management staff participated	Tanzania
Bada, J. K. (2022)	Digital learning process - learners view on e-learning	Questionnaire, 39 students participated	Uganda
Dirckinck-Holmfeld et al. (2023)	Digital learning process - students learning practice	Photovoice and workshops. 11 students participated	Uganda
Mwalukasa (2023)	Digital learning process - use of mobile phones among students	Questionnaire, 150 students participated	Tanzania
Kisanjara & Maguya (2024)	Digital learning process - students' perceptions of e-learning	Questionnaire, 241 students participated	Tanzania
Sheila et al. (2022)	Community learning - collaboration between farmers and university	Questionnaire, 466 respondents	Uganda
Honen-Delmar & Rega (2023)	Community learning - refugees' experience from a blended learning program	Interviews, 100 students	Kenya (Malawi)

3.1 *Professional Development*

One of the papers within the category of professional development from the first search, Kemppainen et al. (2012) focus on education of local IT professionals who are competent in IT service management in a given context. The rest of the papers in this category concerns teachers' professional development, thus Foley and Masingila (2014) concentrate on explicating the challenges in teaching large classes (between 300 and 1000 students) and how to use technology to support a large class pedagogy that is efficient and meaningful for the students. There are two papers (Onguko et al., 2013; Onguko, 2014) that study how to use IT to enable teachers to participate in professional development activities without leaving the rural area where they live and work. The specific professional development course examined is about instructional design and blended learning and focuses on the importance of appropriate hardware and locally rooted development of content. Lastly, the paper by Tondeur et al. (2016) discusses five challenges (identified at the International Summit on ICT in Education, 2015) for teacher professional development concerning application of technology to support learning processes. The paper also presents four cases from around the world, one from Kenya, focusing on more context specific challenges and solutions e.g., the experience from Kenya were that schools were provided with expensive equipment, but with marginal support for teachers, which prevented the technology from working as intended.

Of the five papers found in the second search that belongs to this category three of them are questionnaire surveys aiming at explicating different aspects of teachers and staff practice concerning the use of digital technology. Thus, Almas and Machumu (2021) focus on instructors' perspectives, motivational attitudes and competences, whereas Bariu and Chung (2022) concentrate on how teachers' attitude might influence the implementation of ICT, and Anasel and Swai (2023) focus on explicating the factors that hinder the adoption of online teaching. Goshtasbpour et al. (2022) describes the development of an online course aimed at enhancing the knowledge and skills of educators, educational managers, and support staff in online education within the context of the demands put forward by the Covid-19 pandemic. The development was run by Open University UK, with participants from 37 Kenyan universities and involved the use and adoption of Open Educational Resources (OER). The challenges identified were among other things that the course must meet national, local and individual needs, be adapted to the local context, consider restricted internet access, acknowledge constraints on learners such as workload and limited time, and offer technical support. The paper by Loyola-Hernândez et al. (2022) uses an autoethnographic method to describe how academic staff placed at three different universities in Kenya, Mexico and

the United Kingdom experienced the Covid-19 lockdown. They describe the demands for rapid adjustment to online teaching during the first month of the lockdown without adequate IT equipment and training, and without reflection on how this transition impacted the pedagogy. This was a stressful experience for the academic staff and the authors also point out that access to online learning was especially difficult for learners from more vulnerable families as many have no computers and smartphones which made inequality in access to education even higher. On the positive side the authors mention small online groups and one-to-one meetings as something that had a positive impact and also as a way of realising a more critical pedagogy implying a student-centred approach to learning.

3.2 *Supporting the Digital Learning Process*

In the four papers that focus on issues concerning supporting the digital learning process from the first search one is addressing the use of open educational resources (Muganda et al., 2016). More specifically the paper explicates the existing status of open educational resources (in open education in Tanzania) and based on workshops with people with knowledge on the topic, identify critical issues in the production, use, and dissemination of open educational resources to formulate recommendations and a policy to guide the procedures and practices around open educational resources. In line with this, two papers address the deployment and utilisation of mobile learning objects (Muyinda et al., 2010, 2011) Learning objects are a sort of educational resource, and also meant to be reusable, but the content is not necessarily open. In Muyinda et al. (2010) a scenario drawn from the department of distance education at a university in Uganda is used to identify and model distance learners' information and learning needs. The idea is to use learning objects on mobile phones to provide e.g., course material, study guides, take home assignments, different kinds of feed-back, but also more administrative information like information on examination dates and venues, fee payment etc., and moreover allowing learners to communicate with each other, teachers, and the administration. In Muyinda et al. (2011) a framework consisting of 12 dimensions is suggested to support the design and evaluation of learning objects on mobile phones. Finally, the fourth paper in this category investigates how different pedagogical designs of the learning environment influence student interaction, collaboration, and use of resources in an undergraduate chemistry course (Msonde & Van Aalst, 2017). More specifically three designs were tried: one provided access to resources but with no interaction built in (as baseline), one with added activities in discussion forums, and one with both discussion forums and podcasts as tools. The podcasts are short video or audio episodes

explaining specific issues. The design including both discussion forums and podcasts were considered most successful in achieving student engagement and learning.

Two of the eleven papers in the second search focus on uncovering student and staff general use of mobile devices and the challenges associated with this. Ghasia et al. (2018) do qualitative interviews with teachers (25), students (53), and ICT experts (6) from four public universities in Tanzania. The findings reveal that mobile devices (smartphone, tablets, laptops) are widely used but also that limited network coverage, some students' inability to afford mobiles, lack of qualified staff for preparation of mobile content, gaps in existing policies, and faculty course design hinder the deployment of mobile learning at the universities represented in the investigation. Pete and Soko (2020) evaluates in the light of Covid-19 pandemic the instructor and learner preparedness for online learning through a structured questionnaire for lectures and students from different universities in Kenya, Ghana and South Africa, 2,341 answered the questionnaire, hereof 842 from Keya. The study focused on what devices were used (desktop computer, laptop computer, tablets, mobile phones), literacy level, from where they accessed (home, friends' home, internet café, public library, etc.) and finally level of satisfaction). The findings revealed that most learners and instructors used laptops and smartphones, except from Kenya where there also was a high use of desktop computers. The use of tablets was the least used among the participants. The literacy level was intermediate, which meant that respondents were able to use a range of applications. Most of the respondents from all three countries accessed the internet from university or work. And finally, there was a low level of satisfaction with the internet connection, cost and reliability. Based on the study the authors recommend among other things that universities should shift from investment in on-campus desktops, to support instructors and learners by allocating internet bundles to them to use from anywhere, and furthermore lobby for subsidised internet bundles from internet providers.

Focusing only on students, Namirembe and Kyobe (2021) examine the predictors of successful adoption of technology-supported learning among students in two universities in Uganda. The study identifies organisational and individual factors that influence the adoption of technology supported learning. Data was collected from 184 students from 2 different universities in Uganda. The factors influencing the adoption include the goal of the policy, time to experiment with ICT, financial support, and commitment of university management.

Based on the study's findings, recommendations for universities in developing economies include strengthening management capabilities, increasing

the time students can experiment with ICT, and introducing technology supported learning at earlier stages to enhance adoption. Dirckinck-Holmfeld et al. (2023) offers insights into the students' study practices and how they navigate challenges in their educational journey. Data was collected from photovoice and workshop activities with 11 students from three different faculties. The findings show that students face challenges in accessing Wi-Fi and power, with smartphones being their most used ICT tools. Tasks are primarily curriculum-directed, and collaboration is a key aspect of their study practices. Students are dedicated to pursuing their professional careers while also supporting their communities. The study highlights the importance of understanding students' study practices when transforming education and emphasises the need for access to basic tools like Wi-Fi and power. Mwalukasa (2023) investigated the utilisation of mobile phones as a tool for learning among postgraduate students at a university of agriculture in Tanzania.

Data collection was carried out using structured questionnaires with both open and closed questions. 120 students from the different faculties of the university participated. The findings showed that students frequently used mobile phones for sharing and reading lecture notes, downloading academic materials, communicating with supervisors, and watching tutorial videos. The authors recommend that educational experts should explore more in-depth how to use mobile phones as a learning tool.

Mwandosya and Mbise (2019), Mwandosya et al. (2022) present evaluations of a prototype (CBEMET) allowing teachers to interact and share educational content with each other and with students with the goal of innovating teaching and learning. The prototype was evaluated at the college of business education at a university in Tanzania. The university has four campuses and in the first evaluation 40 teachers and 160 undergraduate students from one campus participated. In the second evaluations 40 teachers and 542 students + some managerial staff from all four campuses were involved in the evaluation. Data was collected through interviews, focus groups, and questionnaires. The findings show that students and teachers were satisfied with the functionality of the system and also the included forums and chats that allowed teachers and students to communicate with each other. Thus, the system made it possible to share educational resources among the teaching staff themselves, between teachers and students, and among students in all four campuses. It is concluded that the system paved the way for innovating teaching and learning through peer group discussions and easy sharing possibilities.

Two papers report from experiments with IT in a specific course setting. Bagarukayo (2018) discusses the use of Facebook to facilitate learning and knowledge transfer into practice. It highlights a study where second year

students undertaking an Operating System course at a university in Uganda were tasked with recording and uploading a video of installing operating systems onto a virtual machine on a Facebook group. After the course a questionnaire was filled in by 48 students. The study shows positive effects of using Facebook for learning, including increased collaboration, interaction, and practical skill development. Students found the experience engaging and effective, leading to greater understanding of concepts and improved interaction with peers and instructors. The study recommends integrating Facebook as a learning tool due to its familiarity and ease of use. Bada (2022) discusses the evaluation of blended learning for a Systems Analysis and Design course in an MBA class at University Business School in Uganda. The study used Moodle for online course delivery and gathered feedback from 39 postgraduate students through questionnaires. The results showed that students strongly recommended the e-learning approach, citing benefits such as easy access to lecture materials, efficient coursework administration, flexibility in learning, and cost-effectiveness. However, students also highlighted challenges such as lack of ICT equipment, slow Internet speed, and power/electricity issues.

The last two papers in this category focus on the implementation of an e-learning system at one university in Tanzania. Ghasia et al. (2020) describes the historical background of the system that goes back to 2009 when Moodle was first implemented, and the paper reflects on both successes and challenges as well as recommendations for the way forward. The paper provides insights into the e-learning system adoption, utilisation, and practices at the university. It discusses the use of the Moodle platform for course delivery and student engagement. The findings indicate a notable increase in courses taught via blended pedagogy, along with efforts to establish online and blended learning programs to enhance academic delivery and student-teacher interactions. Despite progress, the research identifies critical challenges faced by the institution, including limited ICT infrastructure, inadequate ICT skills among students and teachers, lack of technical expertise in digital content design, and an over-reliance on traditional teaching methods. The authors offer recommendations for the way forward, emphasising the need for institutional alignment of e-learning initiatives with organisational strategies, user support, and continuous training for educators. It highlights the importance of understanding organisational needs before technological decisions and underscores the role of educators in driving successful e-learning transformations within academic institutions. The study by Kisanjara and Maguya (2024) focuses on the low uptake of e-learning among students at the same university in Tanzania. Data was collected through a questionnaire which was responded to by 241 students. Focus is on students' perceptions and the factors influencing the use

of e-learning, such as infrastructure, technical support, Internet connectivity, and the quality of e-learning materials. The research found that students had a negative perception of e-learning due to factors like inadequate Internet connections, low-quality learning materials, lack of user training, and slow system accessibility.

3.3 *Community Learning*

The three papers on community learning from the first search address different issues and target groups. Jobe and Hansson (2014) describes experiences from creating and running a MOOC on human rights, a course that was available for free, to anyone living in Kenya. In creating the MOOC focus was on ensuring access from any device, especially mobile by using a responsive design, to include audio recording of all textual content to mitigate poor literacy, and to encourage use of personal experiences to stimulate discussion on human rights. Furthermore, a certificate and a digital badge was offered to participants who completed the course. Another paper, Roy et al. (2012) addresses the problem of forest fires in Tanzania. Forest fire is an example of a problem which is highly relevant for the community but not addressed anywhere in the educational system. The paper describes how video was used as material in problem-based learning, in this case in high schools. The paper includes reflections on the challenges of using ICT in educational activities and the advantages of problem-based learning. The third paper, by Sanga et al. (2016) describes the development of a prototype of a mobile phone application to support blended learning for smallholder farming communities in Tanzania. Focus is on developing innovative ways of communicating and disseminating agricultural information and proven agricultural technologies from either extension agents, research centres or universities to farmers. Within the same area the paper by Sheila et al. (2022) from the second search evaluates rural farmers' readiness and intention to use a dairy application for collaboration with a higher education institution in Uganda. Data was collected from 466 respondents in a region of Uganda through a survey. It was found that awareness and normative influence positively affect farmers' preparedness to collaborate through the application. Factors such as readiness, self-efficacy, perceived ease of use, perceived usefulness, hedonic attitude, and utilitarian attitude have a positive impact on farmers' intentions to use the application. The study concludes that understanding these factors is essential for developing effective technology-driven strategies for collaboration.

The university plans to use the application to collaborate with farmers in the future. The last paper in this category by Honen-Delmar and Rega (2023) discusses a research study on how refugees in camps, who completed a

blended higher education program, developed intercultural competence. The study specifically focuses on the experiences of 100 refugee graduates of the Diploma in Liberal Studies program, which is accredited by Regis University (US) and delivered by Jesuit Worldwide Learning in refugee camps in Malawi and Kenya. The online part of the program allows students to access content, to hand in weekly assignments and to participate in a global online discussion forum, whereas on-site activities are centred around weekly discussions in a community learning centre, facilitated by an on-site facilitator, often a graduate student.

Data consisted of qualitative interviews done by local facilitator/instructors. The research found that the program helped refugees build intercultural competencies through knowledge, skills, attitudes, and behaviours. Graduates gained new perspectives on religion and culture, improved conflict-resolution skills, and showed more inclusive attitudes towards other cultures. The outcomes of the program included fostering peaceful coexistence, enhancing community understanding, and empowering individuals to engage in intercultural interactions.

3.4 *Use of Digital Technologies and Pedagogical Implications*

The above overview represents almost 15 years of experience in the use of information technology in educational activities in East Africa. In this context, the term "educational activities" includes initiatives directed towards educators, towards learners and staff in higher education, and towards citizens/the surrounding community. The first search yielded an almost equal distribution of papers across three themes: professional development (five papers), supporting the digital learning process (four papers), and community learning (three papers). However, the second search revealed a notable surge in papers exploring the integration of digital learning in higher education. This might be due to increased access to computing devices and internet, but also the disruption of ordinary teaching practices caused by the Covid 19 pandemic. The impact of the close-down of the universities in connection with the Covid-19 pandemic is explicitly addressed in four papers (Loyola-Hernández et al., 2022; Goshtasbpour et al., 2022; Anasel & Swai, 2023; Pete & Soko, 2020).

Four more papers mention Covid 19 as one of the reasons to work with e-learning (Namirembe & Kyobe, 2021; Mwandosya et al., 2022; Bada, 2022; Kisanjara & Maguya, 2024). However, no matter how many papers explicitly addressing the pandemic, as Kipkorir David put it in a blogpost from July 2021: "Covid 19 has forced a greater demand for digital reliance across the board, and this outcome is likely to be here to stay as the 'new normal'". The more widespread use of digital technologies in higher education can also be seen

in the increasing tendency for studies to focus on the institutional or cross-institutional level rather than the course level. Overall, the papers from professional development emphasize the importance of context-specific solutions and institutional support for educators, the papers on supporting the digital learning process stress the importance of addressing technological barriers, enhancing resource sharing and adapting pedagogical strategies to improve educational practice, and papers from the community learning category illustrate innovative approaches to education and community engagement.

The use of Moodle is explicitly addressed in nine of the papers (Foley & Masingila, 2014; Msonde & Van Aalst, 2017; Jobe & Hansson, 2014; Almas et al., 2021; Anasel & Swai, 2023; Ghasia et al., 2020; Bada, 2022; Dirckinck-Holmfeld et al., 2022; Kisanjara & Maguya, 2024). Moodle is not always the first Learning Management System used at the universities, some mention e.g. Blackboard or other proprietary software system, but the reason given in many of the papers for having Moodle is that it is open source. Other learning platforms described in the papers include a prototype developed at a college of business education specifically for sharing education-related resources (Mwandosya & Mbise, 2019; Mwandosya et al., 2022), and Bagarukayo (2018) who analyses the use of Facebook to facilitate learning in an operating system course. In terms of more specific uses of Moodle and other learning platforms, Almas et al. (2021) mention 'the provision of teaching notes, assessments and feedback, course outlines, and for grading students' work online' (Almas et al., 2021, p. 76), and Anasel and Swai (2023) mention teaching slides, course outlines, and journal articles used in teaching. Bada (2023), who focuses on the students, emphasises their appreciation of the flexibility in submitting assignments, sharing knowledge through the discussion forum, accessing the learning materials, and seeking advice from the course instructor and class members. However, Dirckinck-Holmfeld et al. (2023) also identified problems enrolling students to Moodle due to lack of procedures, and difficulties for students managing passwords.

The fact that mobile devices and mobile network connectivity are much more widespread in East-Africa than desktop computers and wired broadband, means that many of the pedagogical experiments reported in the papers are based on, or include mobile devices, that is primarily smartphones but also laptops and tablets. This reflects, as expressed in one of the papers that … 'it is possible and probably beneficial for tertiary institutions in Africa to leapfrog universities in western countries by not creating large, complex wired networks and instead focus on developing wireless and mobile capacity on their campuses' (Foley & Masingila, 2014, p. 804). But use of mobile devices of course also represents a challenge as there is much less experience with

this, than with the use of computers and wired broadband. E.g., the spread of mobile phones makes the use of SMS more accessible than emails as a form of communication, but as stated by (Foley & Masingila, 2014, p. 805) focusing on large class pedagogy, texting also has drawbacks in institutional functionality as the cost and logistic (SMS charges, collecting and managing phone numbers) would be huge. Thus, the SMS message lack the official status that emails have obtained in many western universities. In later papers (Ghasia et al., 2018; Dirckinck-Holmfeld et al., 2023) examine the use of mobile technologies and point out that social media platforms such as WhatsApp and Facebook play an important role in communication and collaboration. The use of mobile phones, mentioned in most papers, is also explored by Mwalukasa (2023), who concludes that although there is a high level of mobile phone ownership among students and that they also use them to some extent for learning purposes, there is still a need to explore creative ways of using mobile phones as learning tools.

Content development and the issue of open educational resources are addressed in several papers. The focus is on the development of contextualised content, including video and audio (Roy et al., 2012; Onguko et al., 2013; Onguko, 2014; Jobe & Hansson, 2014), on strategies for the development and use of open educational resources (Muganda et al., 2016), and on the danger of the dominance of the Global North in sharing English-language neo-colonial practices (Goshtasbpour et al., 2022). Overall, the need to contextualise or localize not only digital content, but digital technology as such, is a recurring theme in most of the papers.

Regarding the impact of the use of digital technology on teaching and learning practices, many contributions mention the more practical aspects, such as the possibility for students to hold a job and study at the same time, saving on transportation and accommodation costs, and easier access to course materials as well as saving the cost of producing them. It is also mentioned (Honen-Delmar & Rega, 2023) that e-learning can serve to overcome physical barriers that students face, for example, living in a refugee camp, to overcome physical barriers to access higher education. Most of the papers include some reflection on how the use of digital technologies is changing teaching and learning practices. Increased interaction and discussion among students and between students and teachers, increased collaboration among students, as well as considering ICT as a change agent and stating that the use of digital technologies brings about a shift from a teacher-centred to a learner-centred pedagogy are mentioned in several papers. Some of the papers also mention that the use of digital technologies stimulates motivation and innovation, and many papers agree that the use of digital technologies enables self-regulated

learning and higher order thinking. The need to work with real-world problems in a student-centred way is also mentioned in some papers. One paper (Bagarukayo, 2018) focuses on how an online platform (Facebook) can be used as a way for students to apply theoretical knowledge about operating systems in practice. Another paper (Loyola-Hernández et al., 2022) discusses the extent to which it was possible to maintain a student-centred approach during the first period of the Covid 19 pandemic. And although there were many challenges, they highlight the possibility of small online groups and face-to-face meetings as something that allows for student-centred approaches. Overall, the awareness and intention to use digital technologies to focus on real-world problems and student-centred approaches is a recurring theme, but despite the many successful experiences with the use of digital technologies, there are also some persistent challenges reported in the papers.

3.5 *Cross-Cutting Challenges*

We identified three main challenges across the papers, that is the importance of access, the need for digital skills, and institutional support.

3.5.1 The Importance of Access

By access we mean access to digital devices (desktops, laptops, tablets, and smartphones), access to reliable and affordable power, and reliable and affordable internet connections. Regarding access to digital devices, the inability of some students to afford smartphones in particular is mentioned (e.g. Ghasia et al., 2018; Mwandosya et al., 2022; Loyola-Hernández, 2022; Bada, 2022). Tondour et al. (2016) mention lack of access to digital devices in general as a challenge, and Ghasia, et al. (2020) mention that the number of computers in computer labs at the university is not sufficient, or not functioning and/or outdated (Dirckinck-Holmfeld et al., 2023). Internet connectivity issues are the most frequently mentioned challenge in all papers. Some of the early papers (Onguko et al. 2013, Onguko 2014) that focus on creating locally relevant content explicitly address this issue by providing access to content both online and on a compact disc (when working offline). They also report on the successful use of tablets with batteries powered by solar energy. In the remaining papers, problems with Internet connectivity and poor infrastructure are mentioned as a challenge, e.g. Pete & Soko (2020) note in their study that there was an 'extremely low satisfaction with Internet connectivity, cost and reliability' (p. 37). Dirckinck-Holmfeld et al. (2023) conclude that access to WIFI and power are major factors in how students organise their learning processes. Several other articles also mention cost, the high price of internet bundles, as a challenge (e.g. Jobe & Hansson, 2014; Mwandosya et al. 2022; Bada 2022).

The papers show that the use of digital technologies in higher education is becoming more widespread. However, the problem of Internet connectivity remains, as documented by Kisanjara and Maguya (2024). They conclude that, after almost 15 years of experience with Moodle, the main reasons given by students for the relatively low use of e-learning at their university are unreliable Internet connectivity and also the perceived low quality of the material in the e-learning system.

3.5.2 The Need for Digital Skills

The lack of skills to use digital technologies in learning and teaching is mentioned in most of the papers. In the early papers the focus is more on basic issues such as knowing the functionalities of e.g. Moodle or what kind of apps are available (Onguko et al., 2013; Foley & Masingila, 2014; Onguko, 2014). This is also reflected in later studies, but in general the focus shifts to a more pedagogical perspective on the use of these technologies. There is a concern that instructors use the e-learning system to replicate traditional teaching methods and as formulated by Almas et al. (2021), 'The finding of this study suggest a need to develop instructors' competences in areas such as developing online content, quality assurance issues, interacting with students online, marking and assessing/evaluating learning tasks and activities online' (p. 90). Specifically, the need for skills in developing online content is highlighted in several papers e.g. (Ghasia et al., 2018; Almas et al., 2021; Kisanjara & Maguya, 2024). In addition, teachers should be encouraged to take courses not just once, but as a recurring activity (Bariu & Chun, 2022). In addressing the need for digital literacy, the focus is primarily on teachers, as they, in turn, will be responsible for ensuring that students develop the necessary skills. However, some papers address the need for students to develop skills more directly. For example, Namirembe and Kyobe (2021) suggest that more time should be allocated for students to work with digital technologies in the classroom, and Mwalukasa (2023) suggests that students should be taught how to use mobile phones for educational purposes.

3.5.3 Institutional Support

Most papers end with some advice or recommendation for further work on the use of digital technologies to implement student-centred pedagogy. The recommendation is usually directed at what the university should do as an institution, and many address the challenges mentioned above. For example, it is suggested that institutions ensure the necessary ICT infrastructure, including sustainable connectivity, bandwidth, and electricity. Regarding the availability of digital devices, Pete and Soko (2020) suggest that higher education

institutions should shift their focus from investing in ICT on campus (e.g., computer labs) to supporting learners and instructors by providing them with Internet bundles. They also suggest that universities should provide equipment to students in need. Good logistics and user support, i.e. procedures and systems that make technology work, such as maintenance of e.g. learning platforms and equipment owned by the university, registration and enrolment procedures, and the possibility of user support. The general recommendations are that higher education institutions should formulate or reformulate policies to support the implementation of digital technologies and student-centred pedagogies. The term "policy" implies that certain issues, such as those pertaining to connectivity, capacity building, the utilisation of learning systems, and so forth, must be identified and that strategies for addressing them, including the determination of priorities and the allocation of resources, must be formulated.

4 Discussion and Conclusion

It appears from the papers that transforming education through digital technologies and new pedagogies is a complex process. Conole (2017) suggests that there are three types of research challenges in digital learning, namely research on the underlying technologies, research on pedagogies, and research on organisational issues. These are consistent with the cross-cutting challenges identified in this scoping review. And it is a key finding of this review that the complexity stems from the fact that the problem is systemic, that the technological, pedagogical and organisational issues are intertwined and all need to be addressed to successfully transform education.

The review highlights the critical role of digital technologies in transforming higher education in East Africa. Key technologies include learning management systems, especially Moodle, as well as mobile phones and Wi-Fi. The use of these technologies in the region is growing, and several studies reflect the experience of many years. Notably, earlier research tended to focus on course-level implementations, while more recent studies have shifted their attention to institutional and cross-institutional perspectives. Despite this progress, challenges remain. Issues such as internet connectivity, access to digital devices for students, reliable power supply, and the costs associated with internet usage continue to hinder the realisation of effective digital learning. This is explicitly acknowledged and addressed in almost all the papers included in the review.

Pedagogical and organisational issues also play an important role. It is mentioned that the use of digital technologies makes higher education accessible to

more students, that the possibility of access from anywhere allows for a more flexible balance between work and study requirements and saves on travel and accommodation costs, and that online course materials potentially ensure easier access and also save costs for the institution in their production. In addition, there is general agreement that digital technologies bring about a shift from teacher-centred to student-centred pedagogy, stimulate collaboration between students, teachers and the surrounding community, and enable self-regulated learning and higher-order thinking. To realise all of this, there is a need for institutional policies that support the implementation of digital technologies and student-centred learning, as well as the need to strengthen digital literacy, especially among teachers. However, there still seems to be a gap between these pedagogical intentions and the fact that the primary use of digital technologies identified in the papers was the sharing of content such as slides and learning materials. Bekele et al. (2023) suggest that the successful integration of technology in higher education in Africa would require a strategic reform of higher education. They identify the dominant faculty-student relationships and the dictation of pedagogy as a major challenge, they call it a 'master-slave relationship' and suggest that to improve local relevance and ensure faculty and student agency, the overhaul needs to be underpinned by philosophical, theoretical, conceptual and methodological thinking from within Africa. They draw on the philosophical perspectives of Ubuntu and Asabiyya, arguing that these could be the basis for developing more engaging and empowering pedagogies in technology-enhanced spaces (Bekele et al., 2023, p. 1521).

Overall, the activities to transform education through digital technologies and new pedagogical approaches are in line with the idea of the university of the future as articulated in the East African Community Vision 2050, with an emphasis on students being at the centre of their own learning, real-life problems and community engagement. However, many critical questions remain. These include examples of how faculty-student-community collaboration can be implemented in a meaningful way, the relationship between the curriculum and the intention to work with e.g. real-world problems and participatory pedagogies, and what strategies can be used to promote the employability of graduates.

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