ORIGINAL PAPER

Blended learning pedagogy and the development of digital competences among teacher trainees in a predominantly face-to-face teacher education program

Alfred Buluma[1] · Michael Walimbwa[1]

Abstract

This paper examines the influence of blended pedagogy in facilitating the development of digital competences among teacher trainees in a leading University in Uganda. This is an action research that took place between August and November, 2019, in which data were collected from third-year teacher trainees at School of Education in a pre- and post-intervention survey environment. At the beginning of August 2019, a self-administered questionnaire (SAQ) seeking the opinions about the teacher trainees' digital competences was administered. In the course of the semester, the researchers introduced a blended pedagogy approach through offering online tutorials to the teacher trainees using a MOODLE learning management system referred to as Makerere University Electronic Learning Environment (MUELE) in the course unit known as Evaluation of Instruction. Prior to the beginning of semester one examinations in November 2019, the same SAQ was administered to teacher trainees to examine the influence of blending online tutorials in nurturing their digital competences. Findings indicate improved competences in teacher trainees' digital competences in line with navigation in the internet environment, operating mobile internet, operating internet-based search engines, and formal internet skills. Other competences that teacher trainees demonstrated improvement include digital information and communication competences. The study, however, indicated minimal improvement in teacher trainees' digital competences in content creation. Consequently, it is recommended that teacher educators should deliberately adopt the use of blended pedagogy to enable teacher trainees develop the various digital competences expected from the twenty-first-century teacher.

Keywords Blended pedagogy · Digital competences · Teacher education · Teacher trainees

✉ Alfred Buluma
   alfredhenrysbuluma@cees.mak.ac.ug

Extended author information available on the last page of the article

Introduction

Digital competences are one of the skill sets expected from twenty-first-century citizens (Røkenes and Krumsvik 2014). We are living in a digital age with both digital natives and immigrants. Educational institutions are therefore obliged to ensure that they nurture 21st century citizens with appropriate digital competences. Teachers in these educational institutions are thus expected to expose twenty-first-century learners to appropriate digital resources in their day-to-day pedagogy. Pedagogy enshrined in appropriate technology of the fourth industrial revolution has a higher potential to develop necessary digital competences among learners. It is prudent to make educational institutions' activities more efficient and oriented towards permeating society (Machado et al. 2016). A society that has already been immersed by powerful computer systems, mobile technologies, and collaborative Web 3.0 tools in provision of opportunities for learning within and beyond the classroom as well as a generation born into a digital world (State of Victoria 2012 and Kihoza 2016). Unfortunately, for a long period of time, teachers have always used a range of learning activities and resources to assist learners to achieve learning objectives that are devoid of digital competences (State of Victoria 2012). Research literature attributes this difference to in-service teachers, teacher educators, and student teachers' gap between technical knowledge and knowledge on how to use technology in the ideal learning context of the twenty-first century (Haugerud 2011 in Røkenes and Krumsvik 2014).

The UNESCO competences advocated for the twenty-first-century teachers are knowledge of basic hardware and software operations in order to be flexible in the use of a variety of subjects-specific tools and applications (UNESCO 2011 in Røkenes and Krumsvik 2014). Therefore, even if schools are equipped with appropriate digital technologies but when the human resources there lack the skills and attitudes to use them, they will not be put to use (Ogwu 2016). In reality, most practicing teachers in some countries on the globe do not measure up to the UNESCO competence for teachers for the twenty-first century. To reverse the trend, it is urgent that educators prepare trainees with appropriate digital competences and attitudes before they gain employment (Kofi 2014). This can be achieved through integrating digital technologies in the teacher education pedagogy (Kay 2006 in Røkenes and Krumsvik 2014). Nurturing of teacher trainees with digital competences will potentially bring about blended learning in day-to-day pedagogy.

The concept of digital competence can be broadly defined as "skills, knowledge, creativity, and attitudes that everybody needs in order to use digital media for learning and functioning in the knowledge society" (Erstad et al. 2005, in Røkenes and Krumsvik 2014). It is also defined as, "the ability to use software or operate digital devices, and involves a large variety of complex skills – cognitive, motoric, sociological, and emotional – users needed to have in order to use digital environments effectively" (Eshet-Alkali and Amichai-Hamburger 2004, in Røkenes and Krumsvik 2014). Krumsvik's (2011) cited in Røkenes and Krumsvik (2014) defines digital competence as "the teacher's proficiency in using ICT

in a professional context with good pedagogic-didactic judgment and his or her awareness of its implications for learning strategies and the digital molding of pupils and students" (Krumsvik 2011b, in Røkenes and Krumsvik 2014). Therefore, digitally competent teachers promote student subject learning, as well as equipping them with the necessary digital skills and attitudes to function in the twenty-first-century knowledge society (Røkenes and Krumsvik 2014). Digital competences are also defined as a body of knowledge, abilities, and attitudes that are required when ICT and digital media are used to perform tasks, solve problems, communicate, manage knowledge, collaborate, create and share content, as well as build knowledge in an ethical and reflective manner about work, leisure, participation, learning, socialization, consumption, and empowerment (Ferrari 2012 in Machado et al 2016). McGuinness and Fulton (2019) citing Carretero et al. (2018) argues that the knowledge, skills, and attributes associated with being digitally competent are identified in several recent models and frameworks, including the European Commission's Digital Competence Framework 2.1 which is structured in dimensions, and includes "components of digital competence," i.e., information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. Other frameworks are the Ireland's National Forum for the Enhancement of Teaching & Learning's "Metro Map that have attempted to capture the multi-faceted, yet overlapping range of capabilities and practices that have evolved in response to the emerging digitization of academic and professional life" (National Forum for the Enhancement of Teaching and Learning, 2015 in McGuinness and Fulton 2019). The Metro Map suggests Tools and Technologies, Create and Innovate, and Identity and Wellbeing as categories for digital skill development (McGuinness and Fulton 2019).

Blended learning

Blended learning is also defined as the engagement of students in learning using technology (computers, mobile phones, i-pads) in online activities and some minimum face-to-face (f2f) interactions (Basheka et al. 2016). Blended learning is the thoughtful learning experience that integrates some use of ICTs like mobile and online learning in addition to face-to-face instruction (State of Victoria 2012; Basheka et al. 2016). In other words, learning may be positioned as f2f classroom instruction combined with online exercises or may take the form of podcasts or synchronous online discussion, followed by f2f meetings with a tutor or lab instruction (McGuinness and Fulton 2019).

Traditionally, blended learning referred to the use of a range of resources and activities to provide individualized as well as student-centered learning experiences for their students (State of Victoria 2012). Improvement in technology that supports internet connectivity has, however, broadened the scope of how to blend learning opportunities. Research has continuously demonstrated the growing trends that students learn better with computers (Basheka et al. 2016; McGuinness and Fulton 2019). Consequently, blended learning that requires educators to utilize the internet's connectivity within and beyond physical classrooms to provide learning

opportunities to students has gained prominence (State of Victoria 2012). Presently, there is a growing use of mobile technologies such as video conferencing, digital cameras, voice recorders, mobile phones, virtual excursions, and GPS devices that facilitate connectivity of learning beyond the four-walled classroom (State of Victoria 2012; Basheka et al. 2016). Therefore, blended learning permits utilization of the elements of both synchronous and asynchronous learning options (State of Victoria 2012; Basheka et al. 2016). The mode of instruction under blended learning might take the form of lecture, discussion, guided practice, reading, games, case study, and simulation that might be delivered through f2f or when they are computer mediated (Hughes 2007 in Kihoza 2016). Different levels of guidance are available in a blended pedagogy ranging from individual learner to content, instructor or expert led to individual learners, or group/social learning (Hughes 2007 in Kihoza 2016).

Blended learning has proved effective in helping schools which create a learning environment that works as a whole as well as meeting the expectations of twenty-first-century learners while addressing the challenges of limited resources and the special needs of many students (State of Victoria 2012; Kihoza 2016). The role of the teacher in blended learning has remained paramount at supporting student activities (Basheka et al. 2016). Dehaidy and Nouby (2008) cited in Crawford and Jenkins (2018) emphasize that to implement blended learning well, teachers need appropriate pedagogic skills in moderation of learning and assessment. State of Victoria (2012) further recommends that teachers must be in position to facilitate the forms of interaction in blended learning, i.e., teacher–student; student–student, and student–community interactions.

Kihoza (2016) citing Aceto et al. (2013) infers the following infrastructures and technologies as clusters that support blended learning:

> the cluster networked collaboration includes Audio-Video-Web Teleconferencing, social networking, social software, social media, blogs and micro-blogging, online collaboration platform and tools, wikis, web 3.0, and Semantic Web. The cluster content includes Video/DVD, Digital Radio, TV/Digital TV, Podcasts, Repositories, Open Educational Resources, Content Management Systems, eBooks, Apps for Content Creation, Management and Sharing, and e-content. Other potential tools are desktop computers, mobile devices, games and games, media creation and editing software, virtual reality, office suite software, simulations and animations software, cloud computing, and the enabling infrastructure (broadband, internet, WiFi).

Theoretical framework

This research drew on the attributes of Activity Theory (AT) (Engeström 1999) to analyze the blended pedagogy and the development of digital competence among the teacher trainees. In curriculum design and development, there is a large basis on AT aimed at bringing out transformation. The premise of AT is that a collective work activity, with the basic purpose shared by others (community), is undertaken by people (subjects) who are motivated by a purpose or towards the solution of a

problem (object), which is mediated by tools and/or signs (artifacts or instruments) used in order to achieve the goal (outcome). AT in this paper provides a conceptual framework from which one can understand the inter-relationship between activities, actions, operations and artifacts, subjects' motives and goals, and aspects of the social, organizational, and societal contexts within which these activities are framed, all in the process of developing digital competences. The development of digital competencies as an activity is constrained by cultural factors including conventions (rules) and social organization (division of labor) within the immediate context and framed by broader social patterns (of production, consumption, distribution, and exchange) Warwick Institute for Employment Research (2020).

In reference to Fig. 1, the subject is the development of digital competencies using the teacher education environment. Blended pedagogies and the methodologies form the tool through which the digital skills are presented to the teacher trainee who is considered the object. All the three, i.e., the subject, tool, and object operate on the basis of rules that exist (this study considers rules as policies governing teacher education). The community (teacher education community) in which students operate during the training equally has a role in the development of digital competences by the students. The university community also has division of labor under which you will find different academics handling different course units and all these play a role in the development of digital competences among the trainees. These attributes interplay to bring out a digitally competent graduate as an outcome of the entire process.

Why embrace Blended learning?

Education institutions that have adopted blended learning advance several reasons in support of this mode of pedagogy. Pedersen (2015) argued that blended learning was adopted at University College Lillebaelt to address the educational needs to match the expectations of the digital native students. Blended learning also
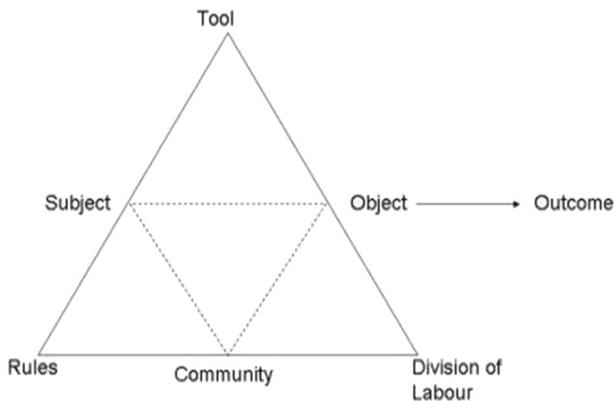

Fig. 1 Illustration of Engeström (1999)'s Activity Theory

helps in individualization and differentiation. That is to offer opportunities to students to determine their own learning paths. Blended learning assists in provision of resources for the individual subjects and groups of students such as those in danger of dropping out through developing asynchronous study activities and learning resources for digital distance learning. Lastly, blended learning improves efficiency of educational efforts through the use of a variety of instructional media like video conferencing, traditional face-to-face teaching to facilitate elements of both synchronous and asynchronous study activities without further costs.

State of Victoria (2012) argues that blended learning was recommended for all secondary schools in Australia because of the benefits highlighted including inclusion of more differentiated/personalized instruction and increased access to resources, experts, and learning opportunities. They go on to add that blended learning allows for more authentic and student-driven tasks incorporated into the curriculum and higher student engagement. In blended learning, there are greater opportunities for collaboration (especially beyond the physical classroom and involving the wider school community). There is exposure to a wide range of Web 3.0 technologies and acquisition of contemporary literacy skills including better access to infrastructure and, anytime, anywhere learning. It has also been understood that through blended learning, there is an increase in learning outcome measures and lowering of attrition rates compared to fully online courses. There are opportunities for students to practice technology skills in navigating online course materials and creating their own digital content for assessment. Blended learning also leads to increase in student–teacher and student–student interaction through the use of communication tools like discussion forums, blogs, and shared web content on the electronic whiteboard. Lastly through blended learning, there is ability to reserve face-to-face time for interactive activities, such as higher-level discussions, small-group work, debates, demonstrations, or lab activities.

Students find blended learning appealing because of its flexibility and the freedom to learn anytime, anywhere. Through blended learning students assume some level of control over the pacing of their learning. Difficult concepts can be reviewed as often as necessary. There is more engaging content that they can create and use their own initiative, and networks to shape the opportunity to engage and draw on expertise that would otherwise not be available to them without costly travel, such as virtual conferencing with zoo/museum/gallery staff or virtual excursions to overseas historical or culturally significant landmarks.

Finally, Eydelman (2013) presented the several arguments for the utilization of blended learning. It is asserted that blended learning is motivating the students to write, which is cited in literature as one of the benefits of using Web 3.0 tools such as blogs and wikis in courses of writing (for example, Turgut, 2009; Krebs et al. 2010 in Eydelman 2013). Blended learning also creates a space for students to share their experiences (Davoli et al. 2009; Richardson 2010; Solomon and Schrum 2010 in Eydelman 2013). Through this kind of learning, students are given opportunities to provide each other with feedback on their writing (Davoli et al. 2009; Richardson 2010; Solomon and Schrum 2010 in Eydelman 2013). In blended learning, informal communication is encouraged (Richardson 2010; Solomon and Schrum 2010 in Eydelman 2013). There is also support given to course management (Bonk and

Graham 2006; Davoli et al. 2009; Solomon and Schrum 2010 in Eydelman 2013). Blended learning also provides additional channels for interaction and opportunities for collaboration (Richardson 2010; Solomon and Schrum 2010 in Eydelman 2013).

Purpose of the study

In light of the numerous benefits of utilizing blended pedagogy, this action research was conducted to improve on teacher trainees' digital competences through utilization of blended pedagogy. Specifically, the study addressed the research question of "To what extent does blended pedagogy nurture the development of digital competences among teacher trainees?".

Context of the study

Teacher education program at Makerere University is available at both graduate and undergraduate studies. The graduate course is a two-semester Post-Graduate Diploma in Education (PGDE). While the undergraduate courses are the pre-service three-year Bachelor of Arts with Education (BAED) and Bachelor of Science with Education (BSCED). In addition, there is a three-year in-service Bachelor of Education (BED). PGDE is offered to students who offered undergraduate courses that grounded them with adequate content knowledge recognized by the Ministry of Education and Sports. While BAED and BSCED are offered to holders of a Uganda Advanced Certificate of Education (UACE) with at least two principal passes to act as their teaching subjects. Finally, BED is offered to holders of a diploma in education from institutions chartered by National Council for Higher Education (NCHE). PGDE, BAED, and BSCED are offered as full-time programs of study taught through f2f at the university campus. On the other hand, While BED is offered as a distance program with both f2f during secondary and primary schools' holidays.

The teacher education model at Makerere University requires that teacher trainees are taught pedagogical knowledge at the School of Education in the College of Education and External Studies while content knowledge from the servicing units. Currently, the servicing units are the Colleges of Humanities and Social Sciences, College of Natural Sciences, College of Agriculture and Environment Studies as well as College of Business and Management Studies (Kagoda and Sentongo 2015; Buluma et al. 2018a).

A Bachelor of Arts with Education and Bachelor of Science with Education student offer an average of ten course units per semester, there are possible timetable clashes (Buluma et al. 2018b). As a result of the clashes on the time table, teacher trainees hardly attend all lectures in any given course unit. Secondly, these clashing course units are offered in different colleges even the time needed to move from one college to the other makes it hard to keep to fully concentrate.

School of Education that is mandated with teaching pedagogical knowledge to teacher trainees is connected to university wireless internet. This internet is accessible to students and staff when they are at campus. However, available computers

are inadequate for the 3,000 students. Nambi (2018) reports that by the time of her study, the computer lab at the School of Education had only 80 functioning computers. However, our observations in the course of the years as teacher educators has established that majority of teacher trainees own and have access to personal equipment technologies like smart phones and laptops in conformity to bring your own device (BYOD) model. Most of the students in the School of Education have limited digital competences. Quite a number of the teacher trainees utilize services of secretarial bureaus to type for them coursework assignments. If there is an opportunity to submit a handwritten assignment, they prefer that than typing. Their submitted typed essays are presented with a lot of spelling errors. Therefore, in light of the limited digital competences among teacher trainees as well as their inability to attend 100% of lectures due to institutional and individual teacher trainees' challenges, an intervention of a blended pedagogy was adopted. Hence, this action research was conducted to improve the digital competences of teacher trainees as well as their pedagogical interaction in the course of the semester.

Materials and methods

Setting

Makerere University uses a MOODLE learning management system customized as Makerere University Electronic Learning Environment (MUELE). MUELE has been in place since 2009. MUELE has affordances that if put to use can facilitate learning in blended or full online learning. Some of the important pedagogical features on the MUELE system are as follows: Discussion forum for both whole- and small-group discussions, Wikis, Blogs, Lessons, and Chatroom. All these features permit learning between the teacher educator and teacher trainees as well as among students themselves. In addition, MUELE has features that permit individual students to interact with content provided or directed to by the facilitators. Specifically, these are folders that are provided by the teacher with selected open educational resources (OERs) for access by students for their individual reading.

Assessment platforms are also in place like the quiz, portfolio, workshops for peer assessment, and assignment folders. Depending on the type of question opted for by the teacher educator, the quiz offers the teacher opportunities to attempt question items that grade them instantly like the multiple-choice questions and one-word short answers. Other types of questions in the quiz have to be graded by the facilitator like short and extended essays. The portfolio is dependent on the facilitator; MUELE has in built e-portfolio that can be opted for or the student made portfolio that can embrace both online and f2f. Further, portfolio can include learning experiences that occur outside the university community. The workshop is a very important assessment feature on the MUELE platform that promotes peer assessment. Facilitators can choose to have their essay questions assessed by peers. Further, the workshop feature permits individual students to carry out self-assessment of their submissions. The facilitator is at liberty to give as many peer assessors to a student. Peer assessors are guided by a rubric set by the facilitator and posted on the MUELE

platform. In addition, marks are assigned to both the submissions and the assessment of colleagues assigned to them. One other important assessment feature on MUELE is the assignment folder. Unlike workshop that offers opportunities for peer assessment, assignments submitted to the assignment folder are specifically assessed by the facilitator.

The instructional and assessment features in MUELE are consistent to number of students and working conditions at Makerere University. With specific reference to the semester one 2019/2020 when the action research was carried out, the course unit of "Evaluation of Instruction" enrolled 1159 teacher trainees. The total student population of 1159 teacher trainees was split into five study groups. Each study group was facilitated in a f2f of two hours once per week. Therefore, the f2f interactions were inadequate to have every student involved in the course of the lecture. Consequently, adoption of a blended pedagogy filled the gap by assigning group and whole class discussion activities on the MUELE platform. Every week, discussion and collaborative wiki activities were assigned on MUELE and measures to ensure that every teacher trainee participates were put in place. Specifically, coursework assignment for this particular semester in this course unit was tagged to a portfolio developed from their reflections and screenshots on the semester f2f and online activities.

Despite the existence of MUELE and its unique features that favor blended and online pedagogy, few teacher educators have embraced it (Muyinda et al. 2020). Most teacher educators are using f2f lectures supplemented by lecture handouts or pamphlets. The nature of assessment is always individual and group take-home assignments as well as tests administered once in a while. Though a few of the teacher educators encourage individual and group presentations as well as community assignments, it is in this pedagogical environment that an action research about the potential of blended pedagogy to improve digital competences among teacher trainees was undertaken.

Validity and reliability of the tool

In surveying the digital competences of teacher trainees at Makerere University, we adopted survey items that were adapted by Van Deursen et al. (2014) from Van Dijk and Peters (2012). The adapted items were used in pre- and post-intervention surveys. The items adopted from Van Deursen et al. (2014) were measured against truthful opinions of the respondent. The truth opinions measured from respondents were 1. "Not at all true of me," 2. "Not very true of me," 3. "Neither true nor untrue of me," 4. "Mostly true of me," 5. "Very true of me," and 6. "I do not understand what you mean by that" to tick off the most appropriate truthful opinion about their digital competence.

Nature of Interaction

Evaluation of Instruction and the course unit in which the action research was conducted had the following topics: evaluation and its related concepts, the role

of evaluation in curriculum development and implementation, types of students' assessments and evaluation, test design and administration, critique of existing assessment, and evaluation tools in terms of their appropriateness plus the role of feedback in promoting effective teaching and learning processes. To ensure that all topics were addressed by the end of the semester, teacher educators employed a blended pedagogy. The nature of the blended pedagogy involved f2f interactions (lectures), online interactions on MUELE, and student-to-student interaction outside the lecture rooms and MUELE. All the interaction proceedings were reflected upon and written about by teacher trainees in their individual portfolios that were submitted online for peer and tutor assessment and feedback. A summary of the pedagogical interactions is presented in Table 1.

Table 1 shows that the nature of interaction in the blended pedagogy utilized in semester one 2019/2020 in the teaching of Evaluation of Instruction comprised of face-to-face lectures, online tutorials, student–content, and student–student interaction. Face-to-face lectures were based on the university-wide time table while online tutorials were asynchronous. Online tutorials permitted both tutor–learner and learner–learner interactions. The student–student interaction outside the lecture rooms was dictated upon by the tutors while student–content interaction is limited to all content that was prepared by tutors in the lecture handouts made available in both softcopy and hardcopy. These modes of interaction are in agreement with Mishra and Koehler (2009)'s TPACK pedagogical model. Therefore, participants were bound to develop technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) at the end of the semester.

The emphasis in this article was put on the development of TK among teacher trainees. Specifically, the TK that was expected to be developed through participation in the blended pedagogy was as follows: operating mobile internet, operating the internet environment, operating internet-based search engines, formal internet skills, digital Informational competences, digital communication competences, digital content creation competences, and online safety.

Selection of participants

The study population consisted of 1159 students who are teacher trainees. Among these, 207 teacher trainees voluntarily consented to respond to the pre-intervention self-administered questionnaire (SAQ) about their digital competences, while 206 responded to the post-intervention survey. Participants were purposively selected among the third-year teacher trainees with specific reference frames related to the program they offer and group they were studying from.

Data analysis

The returned SAQs from teacher trainees were checked for completeness of the responses. The data from the returned pre- and post-intervention SAQs were analyzed using SPSS. The data generated descriptive and inferential statistics that are used in the data analysis process. Descriptive analysis will provide information on

Table 1 Teacher Educator–Teacher Trainee Blended Learning Interactions in Semester One 2019/2020

Topic	Subtopic	Face to Face	Online (MUELE)	Student to Content	Student to Student
Introduction to Evaluation and related concepts	Evaluation	✓		✓	
	Assessment	✓		✓	
	Measurement	✓		✓	
	Testing	✓		✓	
	Accountability	✓		✓	
	Accountability for poor academic performance at the university	✓		✓	
	Monitoring	✓		✓	
	Teacher appraisal	✓			
	Inspection	✓			
	Assessment standards	✓	✓	✓	
	Contrast between assessment and evaluation	✓	✓	✓	
	Reading Benjamin Carson's Story and relationship to one's academic journey/ life	✓	✓		
Role of evaluation in curriculum development and implementation	Primary and secondary roles of evaluation			✓	
	Roles of evaluation to different stakeholders	✓	✓		
	Curriculum tail wags the curriculum dog		✓		
	Evaluation is a necessary evil in an education system		✓		
	Relationship between the poem " Mom Killed my Tomorrow" and Uganda's education system	✓	✓		
	Role of UNEB in Uganda's education system	✓	✓		
	Relevance of repeating a class and changing the school due to a learner's poor performance	✓	✓		
	Evaluation of an existing curriculum	✓	✓		

Table 1 (continued)

Topic	Subtopic	Face to Face	Online (MUELE)	Student to Content	Student to Student
Contextual and philosophical factors influencing curriculum evaluation	Diagnostic assessment	✓		✓	
	Formative Assessments	✓		✓	✓
	Summative assessments	✓		✓	✓
	Internal assessment	✓		✓	✓
	External assessment	✓		✓	✓
	Participatory assessments	✓		✓	
	Criterion and norm referenced assessment	✓		✓	
	Continuous Assessment	✓		✓	
	Ipsative assessment	✓		✓	
Test design and administration	Webb's Depth of Knowledge	✓	✓	✓	
	Bloom's taxonomy of educational objectives	✓	✓	✓	
	Construction of Tables of Specification	✓		✓	✓
	Reflections on challenges encountered while Constructing Tables of Specification			✓	
	Construction of test instruments	✓		✓	✓
	Reflections on how the table of specifications guided one's construction of test instruments			✓	
	Test administration	✓		✓	
	Examination Malpractices		✓	✓	
Critique the existing assessment and evaluation tools	Characteristics of A good Test instrument			✓	

Table 1 (continued)

Topic	Subtopic	Face to Face	Online (MUELE)	Student to Content	Student to Student
Role of feedback in promoting effective teaching and learning	Feedback to Online Peer assessment		✓	✓	
	Feedback to F2f peer assessment	✓			
	Principles of good feedback practices	✓		✓	
	Role of feedback in teaching and learning process	✓	✓	✓	

Source: Evaluation of Instruction Course outline, lecture handouts, and students' portfolios

the basic qualities of digital competencies including descriptive statistics such as range, minimum, maximum, and frequency. It also includes measures of central tendency such as mean, median, mode, and standard deviation. Once the data have been appropriately described, inferences can be made based on that data.

Inferential analysis used statistical tests to see whether an observed pattern is due to chance or due to the intervention effects. This paper used inferential analysis to determine if there is a relationship between the intervention and outcome as well as the strength of that relationship.

Findings

Findings from the investigation are based on the selected digital competences that were investigated. These competencies are as follows: operating mobile internet, operating the internet environment, operating internet-based search engines, formal internet skills, digital Informational competences, digital communication competences, digital content creation competences, and online safety. The study started by investigating the contributions of blended pedagogy on teacher trainees' digital competences to operate mobile internet. The study findings on this competence are reported in Table 2.

Table 2 presents findings on the role of blended pedagogy in nurturing operation of internet digital competences among teacher trainees. Seven descriptors assessed were as follows: I know how to connect to a WIFI network, I know how to turn on data on my mobile device, I know how to turn off data on my mobile device, I know how to download apps to my mobile device, I know how to install apps on a mobile device, I know how to keep track of the costs of mobile app use, and I know how to install apps on a mobile device. Findings indicate that the intervention significantly improved teacher trainees' operation of internet digital competences. Table 2 indicates that teacher trainees' competences of connecting to a WIFI network improved by a mean score of 0.6. Further, knowledge of turning on and off data on one's mobile, downloading apps on mobile devices, and turning off a mobile phone were enhanced by a mean score of 0.5 each. Finally, competences to install apps on a mobile device and knowledge to track costs of mobile app use increased by a mean score of 0.4 and 0.2.

Besides establishing the extent to which blended pedagogy nurtures the development of operating internet digital competences, researchers in this research also investigated the intervention's contribution to facilitation of skills to operate the internet environment. Findings are presented in Tables 3 and 4.

Findings in Table 3 indicate that the intervention to see the contribution of blended pedagogy on the development of digital competences to operate the internet environment registered minimal improvements. On one of the descriptors, the contribution was even negative. Specifically, Table 3 reports that there was only 0.3, 0.1, 0.4, 0.2, 0.5, and 0.3 for knowledge of using shortcut keys (e.g., CTRL-C for copy, CTRL-S for save), competence to open a new tab in a browser, ability to go to the previous page when browsing the internet, competence to use the refresh function, and knowledge to download and upload files. On the other hand, Table 3 indicates

Table 2 Operation of mobile internet

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I know how to connect to a WIFI network	4.1	207	1.2	4.7	205	.83	4.4	412	1.1
I know how to turn on data on my mobile device	4.3	207	1.1	4.8	206	.68	4.5	413	.96
I know how to turn off data on my mobile device	4.3	206	1.0	4.8	205	.68	4.6	411	.93
I know how to download apps to my mobile device	4.2	207	1.1	4.7	206	.76	4.5	413	.98
I know how to turn my mobile phone off	4.3	206	1.1	4.8	206	.79	4.5	412	1.0
I know how to keep track of the costs of mobile app use	3.8	207	1.3	4.0	205	1.4	3.9	412	1.4
I know how to install apps on a mobile device	4.2	207	1.2	4.6	206	.97	4.4	413	1.1

Table 3 Operating the internet environment

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I know how to use shortcut keys (e.g., CTRL–C for copy, CTRL–S for save)	3.8	206	1.4	4.1	206	2.0	3.9	412	1.7
I know how to open a new tab in my browser	3.6	203	1.4	3.7	206	1.5	3.7	409	1.5
I know how to go to the previous page when browsing the internet	3.6	205	1.4	4.0	206	1.3	3.8	411	1.4
I know how to use the Refresh function	3.7	206	1.4	3.9	206	1.4	3.8	412	1.4
I know how to download files	3.8	203	1.3	4.3	205	1.2	4.1	408	1.3
I know how to upload files	3.9	204	3.1	4.1	203	1.3	4.0	407	2.4
If a technical problem occurs while I am using the internet, I usually know how to fix the problem	3.3	204	3.9	3.0	205	1.5	3.2	409	2.9

Table 4 Operating the internet environment

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I know some good ways to avoid computer viruses	3.3	206	1.4	3.2	206	1.5	3.3	412	1.5
I know how to make pop-ups or ads disappear	3.2	205	1.5	3.1	205	1.7	3.2	410	1.6
I know how to open downloaded files	3.8	206	1.3	4.4	205	1.1	4.1	411	1.3
I know which apps/software are safe to download	3.5	201	3.9	3.8	204	3.2	3.6	405	3.5
I know how to download/save a photo I found online	3.8	200	1.4	4.4	204	1.1	4.1	404	1.3
I know how to adjust privacy settings	3.4	204	1.5	3.5	201	1.6	3.4	405	1.6

a negative contribution of blended pedagogy in nurturing operation of the internet environment digital competence in relation to fixing problems in case of a technical fault. This decreased by a mean score of -0.3.

Further, findings about the contribution of blended learning in developing operation of internet environment digital competences among teacher trainees are reported in Table 4.

Table 4 shows that there was a negative contribution of the blended pedagogy on the development of "I know some good ways to avoid computer viruses" and "I know how to make pop-ups or ads disappear" by a mean score of -0.1 each. On the other hand, teacher trainees' operation of the internet environment digital competences improved by 0.6, 0.3, 0.6, and 0.1 for each of these variables: "I know how to open downloaded files," "I know which apps/software are safe to download," "I know how to download/save a photo I found online," and "I know how to adjust privacy settings," respectively.

In addition, the study also investigated the extent to which blended pedagogy nurtures the development of 'operation of internet-based search engines' digital competences among teacher trainees. Study findings on this competence are reported in Table 5. The findings presented indicate that only two variables on 'operating internet-based search engines' digital competences were investigated by the researchers. Blended pedagogy had a positive contribution on these variables. That is to say, there was an increment of 0.2 and 0.5 mean scores in teacher trainees' competences to open a Web address directly without using a search engine like Google and completion of online forms, respectively.

Further still, researchers also investigated the contribution of blended pedagogy in facilitating the development of formal internet skills. The detailed findings on this competence are reported in Table 6.

Study findings in Table 6 indicate that with the exception of the variable about "I know where to click to go to a different webpage," researchers' intervention of facilitating evaluation of Instruction through a blended pedagogy yielded positive results. Specifically, teacher trainees' opinions by the end of the semester had drastically changed from 3.2 to 2.8 (0.4), 3.2 to 2.8 (0.4), 3.1 to 2.(0.5), 3.1 to 2.7 (0.4), and 3.1 to 2.5 (0.7) about their digital competences related to the following: " I get tired when looking for information online," "I find the way in which many websites are designed confusing," "All the different website layouts make working with the internet difficult for me," "Sometimes I end up on websites without knowing how I got there," and "I find it hard to find a website I visited before." Therefore, blended pedagogy had significant improvement of teacher trainees' formal internet digital competences.

Besides internet operational and formal skills, researchers investigated the contribution of blended pedagogy in nurturing digital informational competences among teacher trainees. The results of the investigation on this competence are presented in Tables 7 and 8. Study findings in Table 7 shows that after the intervention, teacher trainees' competences on variables of "I know how to save or store online files and content (e.g., texts, pictures, music, videos, and web pages)" and "I find it hard to decide what the best keywords are to use for online searches" decreased by mean scores of -0.02 and -0.9. However, the intervention

Table 5 Operating internet-based search engines

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I know how to open a Web address directly without using a search engine like Google	3.0	206	1.5	3.2	206	1.6	3.1	412	1.6
I know how to complete online forms	3.1	202	1.5	3.6	203	1.6	3.4	405	1.5

Table 6 Formal internet skills

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I get tired when looking for information online	3.2	205	1.5	2.8	206	1.6	3.0	411	1.6
I find the way in which many websites are designed confusing	3.2	200	1.5	2.8	206	1.6	3.0	406	1.6
All the different website layouts make working with the internet difficult for me	3.1	204	1.5	2.6	205	1.6	2.8	409	1.6
Sometimes I end up on websites without knowing how I got there	3.1	204	1.5	2.7	206	1.7	2.8	410	1.6
I find it hard to find a website I visited before	3.1	205	1.5	2.5	204	1.6	2.7	409	1.6
I know where to click to go to a different webpage	3.6	202	1.4	3.7	204	1.6	3.6	406	1.5

Table 7 Digital information competences

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I know whom to follow in online information sharing places (e.g., micro-blogging, Facebook, WhatsApp groups)	3.9	206	1.4	4.0	206	1.5	4.0	412	1.4
I can filter and monitor the information I receive	3.7	202	1.5	3.7	206	1.5	3.7	408	1.5
I can retrieve and manage the information and content I saved or stored on my digital device	3.9	206	1.4	4.3	203	3.8	4.1	409	2.9
It is easy for me to find information online	3.9	204	1.3	4.2	203	1.3	4.1	407	1.3
I know how to save or store online files and content (e.g., texts, pictures, music, videos, and web pages)	4.3	205	3.7	4.2	205	1.3	4.3	410	2.7
I know how to use a wide range of strategies when searching for information	3.8	207	1.4	3.8	206	1.5	3.8	413	1.5
I find it hard to decide what the best keywords are to use for online searches	3.4	202	1.6	2.5	206	1.6	3.0	408	1.6

Table 8 Digital informational competences

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I am confident selecting search results	4.1	205	4.5	3.9	204	1.5	4.0	409	3.4
I normally look at more than the top three search results	3.6	202	1.5	3.8	202	4.3	3.7	404	3.2
Sometimes I find it hard to verify information I have retrieved	3.4	198	1.6	2.9	205	1.9	3.2	403	1.8
I feel confident in my evaluation of whether a website can be trusted	3.5	202	1.5	3.3	205	1.6	3.4	407	1.6
I generally compare different websites to decide if information is true	3.6	205	1.5	3.9	206	3.9	3.7	411	3.0
I carefully consider the information I find online	4.0	206	3.1	4.0	203	1.4	4.0	409	2.4

had a positive contribution in nurturing "I know whom to follow in online information sharing places (e.g., micro-blogging, Facebook, WhatsApp groups)," "I can filter and monitor the information I receive," "I can retrieve and manage the information and content I saved or stored on my digital device," "It is easy for me to find information online," and "I know how to use a wide range of strategies when searching for information" by the following mean scores: "0.1, 0.0, 0.4, 0.3, and 0.0," respectively.

Another set of the contribution of blended pedagogy in nurturing Digital Informational Competences is presented in Table 8;

Table 8 reports that four of the variables investigated were negatively impacted by the intervention. These are "I am confident selecting search results," "Sometimes I find it hard to verify information I have retrieved," "I feel confident in my evaluation of whether a website can be trusted," and teacher trainees' truthful opinions declined by mean scores of; -0.1, -0.5, and -0.2, respectively. However, two of the variables of the Digital Informational Competences were positively impacted by the blended pedagogy intervention. These are "I normally look at more than the top three search results" and "I generally compare different websites to decide if information is true" by mean scores of 0.2 and 0.3. One of the variables related to "I carefully consider the information I find online" participants remained indifferent with zero changes in the mean scores.

In addition to operation of internet and digital information competences, the contribution of blended pedagogy in nurturing digital communication competences was also investigated. Findings of the investigation on this competence are presented in Tables 9 and 10.

Table 9 reveals that four of the digital communication variables were positively impacted by the blended pedagogy intervention. These are "I can interact with others using basic features of communication tools (e.g., mobile phone, VoIP, chat or email)," "I know when I should and shouldn't share information online," "I am careful to make my comments and behaviors appropriate to the situation I find myself in online," and "I know how to change who I share content with (e.g., friends, friends of friends or public)." These digital communication variables were improved by the following mean scores 0.4, 0.3, 0.2, and 0.1, respectively. Two variables related to "I am aware of the benefits and risks related to digital identity" as well as "I know how to remove friends from my contact lists," participants never registered any change in their mean scores after the intervention.

The rest of the digital competences that were investigated are reported in Table 10.

Table 10 indicates that the blended pedagogy had a positive contribution towards the development of the following digital communication competences among teacher trainees. "I am confident about writing a comment on a blog, website or forum," "I know how to use emoticons (e.g., smileys, emojis or text speak)," "I know which information I should and shouldn't share online," and "I can participate in social networking sites and online communities, where I pass on or share knowledge, content, and information." Teacher trainees' digital communication competences in these variables were enhanced by the following mean scores: 0.2, 0.4, 0.1, and 0.2, respectively. However, the blended pedagogy intervention in teacher

Table 9 Digital communication competences

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I can interact with others using basic features of communication tools, (e.g., mobile phone, VoIP, chat or email)	4.2	203	1.3	4.6	204	1.0	4.3	407	1.2
I know when I should and shouldn't share information online	4.2	199	1.3	4.5	204	3.7	4.3	403	2.8
I am careful to make my comments and behaviors appropriate to the situation I find myself in online	4.2	204	1.3	4.4	205	1.3	4.2	409	1.3
I know how to change who I share content with (e.g., friends, friends of friends or public)	4.1	202	1.3	4.2	206	1.3	4.2	408	1.3
I am aware of the benefits and risks related to digital identity	4.1	200	1.5	4.1	205	1.4	4.1	405	1.4
I know how to remove friends from my contact lists	4.3	200	1.2	4.3	205	1.3	4.3	405	1.2

Table 10 Digital communication competences

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I am confident about writing a comment on a blog, website or forum	4.0	202	1.6	4.2	206	3.8	4.1	408	2.9
I feel comfortable deciding who to follow online (e.g., on services like Twitter or Tumblr)	4.2	201	1.3	4.0	206	1.5	4.1	407	1.4
I know how to use emoticons (e.g., smileys, emojis or text speak)	4.0	201	1.4	4.4	206	5.5	4.2	407	4.0
I know which information I should and shouldn't share online	4.3	196	1.3	4.4	203	1.3	4.3	399	1.3
I can participate in social networking sites and online communities, where I pass on or share knowledge, content and information	4.0	202	1.4	4.2	205	3.8	4.1	407	2.9

education had a negative contribution to teacher trainees' digital communication skills related to "I feel comfortable deciding who to follow online (e.g., on services like Twitter or Tumblr)" by a mean score of -0.2.

The affordances of blended learning in developing digital content creation competences among teacher trainees were investigated too. Findings on this competence development are presented in Table 11.

Table 11 reports that six digital content creation competences were investigated. Findings in the study reveals that to a large extent blended pedagogy negatively contributed to the development of digital content creation competences as indicated by the decline in the mean scores between the pre- and post-intervention survey results. Specifically, there was a mean score decline of -0.2, -0.1, -0.8, and -0.7, respectively. These negative contributions were in response to "I know how to create something new from existing online images, music or video," "I know how to make basic changes to the content that others have produced," "I know how to design a website," and "I know which different types of licenses apply to online content." To a less extent, blended pedagogy positively contributed to the development of two digital content creation competences. Namely, "I would feel confident putting video content I have created online" and "I would feel confident writing and commenting online." These were positively enhanced by 0.5 and 0.4, respectively.

Finally, the researchers investigated the contribution of blended pedagogy in nurturing digital safety competences among teacher trainees. The results of the investigation are reported in Table 12.

Table 12 reports that to a large extent, the intervention of the blended pedagogy had a positive contribution on the development of teacher trainees' digital safety competences. That is to say, teacher trainees' digital safety competences related to the following: "I can take basic steps to protect my devices (for instance: by using anti-viruses, passwords, etc.)," "I know that I can only share certain types of information about myself or others in online environments," and "I know that technology can affect my health, if misused" were enhanced positively by 0.1 mean scores each. While the variable concerned with "I take basic measures to save energy," participants changed with zero mean scores, respectively. However, to a less extent, the intervention negatively impacted teacher trainees' digital safety competences related to the following: "I know how to find a good balance between online and off-line worlds" and "I know how to avoid cyber bullying" by -0.3 and -0.544 mean scores, respectively.

Conclusion

From the study findings, it is hereby concluded that to a large extent, blended pedagogy of f2f and online pedagogy has a positive contribution in facilitating the development of digital competences among teacher trainees in a predominantly face-to-face program. However, to a large extent, the contributions are still mild hence calling for concerted efforts of all teacher educators in the university to adopt use of blended pedagogy. The use of blended pedagogy especially by servicing units is most likely to improve the teacher trainees' digital content creation competences

Table 11 Digital content creation competences

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I would feel confident putting video content I have created online	3.6	204	1.5	4.1	206	1.0	3.9098	410	4.4
I would feel confident writing and commenting online	3.9	197	1.4	4.3	205	3.6	4.1	402	2.7
I know how to create something new from existing online images, music or video	3.4	204	1.5	3.2	204	1.7	3.4	408	1.6
I know how to make basic changes to the content that others have produced	3.5	204	1.5	3.4	201	1.6	3.5	405	1.6
I know how to design a website	3.0	203	1.7	2.2	204	3.2	2.6	407	2.6
I know which different types of licenses apply to online content	3.0	201	1.6	2.3	204	1.6	2.6	405	1.6

Table 12 Digital safety competences

Intervention	Pre-Intervention			After Intervention			Total		
	Mean	N	Std. Deviation	Mean	N	Std. Deviation	Mean	N	Std. Deviation
I know how to find a good balance between online and off-line worlds	3.4	204	1.6	3.2	205	1.7	3.3	409	1.7
I can take basic steps to protect my devices (for instance: by using anti-viruses, passwords, etc.)	3.7	204	1.5	3.8	205	3.2	3.8	409	2.5
I know that I can only share certain types of information about myself or others in online environments	3.8	203	1.4	3.9	205	1.5	3.9	408	1.5
I know how to avoid cyber bullying	3.4	202	1.6	2.9	204	1.8	3.2	406	1.8
I know that technology can affect my health, if misused	4.0	205	1.4	4.1	205	1.4	4.1	410	1.4
I take basic measures to save energy	3.9	205	1.4	3.9	204	1.6	3.9	409	1.5

that were adversely affected by this intervention. This is because, servicing units are responsible for content knowledge development among teacher trainees, yet the intervention was designed and implemented by a department mandated to develop pedagogical knowledge of teacher trainees. Specifically, we were enhancing their abilities to assess their students' learning.

Reference

Aborisade AP (2013) Blended learning in English for Academic Purposes courses: A Nigerian case study. In Blended Learning in English Language Teaching: Course Design and Implementation Edited by Tomlinson, B. and Whittaker, C. London: British Council. Retrieved June 18, 2020 from https://www.teachingenglish.org.uk/sites/teacheng/files/pub_D057_Blended%20learning_FINAL_WEB%20ONLY_v2.pdf.

Basheka B, Lubega TJ, Baguma R (2016). Blended-learning approaches and the teaching of monitoring and evaluation programmes in African universities: Unmasking the UTAMU approach. African Journal of Public Affairs. Volume 9 number 4 December 2016. Retrieved June 18, 2020 from https://utamu.ac.ug/docs/research/publications/journals/Blended-learning%20approaches%20and%20the%20teaching%20of%20monitoring%20and%20evaluation%20programmes%20in%20African%20universities.pdf.

Buluma A, Ezati AB, Najjuma R (2018) Role of teacher education pedagogy in developing communication competences among teacher trainees. A Case of Makerere University –Uganda. International Journal of Excellence Innovation and Development Volume 1, Issue 1, Nov. 2018 Page No. 038 - 045.

Crawford R, Jenkins LE (2018) Making Pedagogy Tangible: developing skills and knowledge using a team teaching and blended learning approach. Aust J Teach Educ. https://doi.org/10.14221/ajte.2018v43n1.8

Engeström Y (1999) Innovative learning in work teams: analysing cycles of knowledge creation in practice. In: Engeström Y et al (eds) Perspectives on activity theory. Cambridge University Press, Cambridge, pp 377–406

Eydelman N (2013) A blended English as a Foreign Language academic writing course. In Blended Learning in English Language Teaching: Course Design and Implementation Edited by Tomlinson, B. and Whittaker, C. London: British Council. Accessed 18 June 2020 from https://www.teachingenglish.org.uk/sites/teacheng/files/pub_D057_Blended%20learning_FINAL_WEB%20ONLY_v2.pdf.

Kagoda AM, Sentongo J (2015) Practicing teachers ̋Perceptions of teacher trainees: implications for teacher education. Horizon Research Publishing. https://files.eric.ed.gov/fulltext/EJ1056076.pdf.

Kihoza DP (2016) A framework for online resources and e-learning implementation (Orei) in Tanzania Secondary Schools. A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy in Information and Communication Science and Engineering of the Nelson Mandela African Institution of Science and Technology. Retrieved June 18, 2020 from http://scholar.mzumbe.ac.tz/bitstream/handle/11192/2037/Patrick%20Daniel%20Kihoza%20dissertation.pdf?sequence=1.

Kilfoil WR (ed) (2015) Moving beyond the hype: a contextualised view of learning with technology in higher education. Universities South Africa, Pretoria

Kofi BW (2014) Impact of emerging technologies on teacher education: experiences of teacher-trainees. J Educ Pract. ISSN 2222–1735 (Paper) ISSN 2222–288X (Online). Vol.5, No.28, 2014.

Machado PSM, Sepúlveda TCG, Montoya RSM (2016) Educational innovation and digital competencies: the case of OER in a private Venezuelan university. Int J Educ Technol Higher Educ 13:10

McGuinness C, Fulton C (2019) Digital literacy in higher education: A case study of student engagement with e-tutorials using blended learning. J Inf Technol Educ Innov Pract 18:1–28

Muyinda P, Aguti N, Bainomugisha A, Kihiigi E, Mugabi P (2020) Fast tracking the implementation of elearning/blended learning at Makerere University. A preliminary proposal of the Adhoc Committee.

Nambi R (2018) Using Activity Theory to Explore the Possibilities of Integrating ICT in the Training of Literature in English teachers at Makerere University: a literature review. Int Learn Teach Educ Res 17(12):135–148

Ogwu N (2016) Comparative analysis of teacher trainee students' e-learning technology (ELT) readiness towards promoting global curriculum best practice. Educ Res Rev 11(17):1679–1688

Pedersen L (2015) Blended learning design: the potentials and pitfalls designing blended learning courses in a professional bachelor context. Accessed 17 June 2020 from https://www.ucviden.dk/portal/da/publications/blended-learning-design(9fef4a87-9c4e-4220-bdb2-8c18db26e65b).html.

Røkenes MF, Krumsvik JR (2014) Development of student teachers' digital competence in teacher education: a literature review. Nordic J Digit Literacy 9(4–2014 s): 250–280

State of Victoria (Department of Education and Early Childhood Development) (2012) Blended learning: a synthesis of research findings in Victorian education 2006–2011. Melbourne: Ultra net and Digital Learning Branch Department of Education and Early Childhood Development. Acessed 17 June 2020 https://www.education.vic.gov.au/Documents/about/research/blendedlearning.pdf.

Van Deursen AJAM, Helsper EJ, Eynon R (2014) Measuring digital skills. From digital skills to tangible outcomes project report. www.oii.ox.ac.uk/research/projects/?id=112.

Authors and Affiliations

Alfred Buluma[1] [ORCID] · **Michael Walimbwa[1]**

Michael Walimbwa
walimbwamichael@cees.mak.ac.ug

[1]   Department of Foundations and Curriculum Studies, School of Education, Makerere University, P.O. Box: 7062, Kampala, Uganda