

Digital Competence for Art and Design Teacher Educators in Uganda's Teacher Training Institutions

Wyclif Edwin Tusiime

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Wycliff Edwin Tusiime

OSLOMET

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Skriftserien

St. Olavs plass 4,

0130 Oslo,

Telefon (47) 64 84 90 00

Postadresse:

Postboks 4, St. Olavs plass

0130 Oslo

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Abstract

The main aim of this qualitative case study is to contribute with insights into teacher educators' digital competence in teaching Art and Design subjects in teacher training institutions (TTIs) in Uganda. The study employed semi-structured interviews and non-participant observations to gather qualitative data from teacher educators (TEs), teacher trainees (TTs) and administrators at two teacher training institutions in Uganda to answer the following research questions (RQs) in order to achieve its main goal.

RQ1: In what ways are teacher educators using digital technology when teaching art and design in Uganda?

RQ2: How do art and design teacher educators develop their digital competence in Teacher Training Institutions in Uganda?

RQ3: What challenges do teacher educators encounter when teaching art and design with digital technology in Uganda?

On the basis of these RQs and theoretical concepts from van Dijk (2005), Mishra and Koehler (2006), data was analysed from which three research articles (*referred to in this thesis as; Article I, II and III respectively*) each addressing one of the RQs were published.

Briefly, the findings in Article I indicate that, TEs occasionally use digital technologies in basic and low creative means to teach in A&D classrooms. This may be attributed to insufficient access to adequate digital resources (hardware, software and internet), insufficient digital skills and knowledge relating to pedagogical use of digital technologies in A&D classrooms. The findings further confirm teacher educators' limited awareness of the relationship between technology, pedagogy and content knowledge (TPACK) in teaching Art and Design subjects. The lack of TPACK among TEs explains the low creative use of digital technologies in teaching A&D lessons in Uganda's TTIs.

The findings in Article II indicate that art and design TEs develop digital competences through both formal and informal approaches. The formal approaches include *continuous professional development (CPD)* and *pre-service training*, whereas informal approaches include *collaboration, self-teaching and repetition*. Apparently, teachers' digital competences (TDC) gained through formal approaches did not relate specifically to the teaching of art and design subjects, making it inadequate and difficult to apply in real classroom practice. Further, the

findings suggest to a larger extent that TEs develop moderate TDC, necessary for practical use in the classroom, through informal approaches.

The findings in Article III reveal numerous motivational challenges (linked to negative attitude, lack of self-confidence, lack of time, inadequate digital competence and fear for loss of creativity) and challenges related to material access such as; lack of adequate access to digital technologies, unreliable electricity supply, technological failures and lack of adequate technical support. Article III further provides and discusses alternative strategies employed by TEs such as peer support, continual practice, improvisation, lobbying for technical and financial support, and advocating for BYOD to cope with the existing challenges.

To sum up, the study findings generally reveal that, teacher educators' digital competences (TDC) remained operational and were not specific to the teaching of art and design subjects, thus being inadequate and difficult to apply in real art and design classroom practice. Due to numerous motivational and material challenges encountered TEs in addition to limited awareness of the relationship between technology, pedagogy and content knowledge, TEs can only occasionally use digital technologies in limited creative ways (basic use) to teach in A&D classrooms.

Sammendrag

Hovedmålet med denne kvalitative casestudien er å bidra med innsikt i lærerutdannernes digitale kompetanse for undervisning i kunst- og designfag i lærerutdanningsinstitusjoner i Uganda. Studien benyttet semistrukturerte intervjuer og ikke-deltakende observasjon for å innhente kvalitative data fra lærerutdannere, lærerstudenter og studieledere ved to lærerutdanningsinstitusjoner i Uganda. På basis av disse dataene belyser denne studien følgende forskningsspørsmål:

- 1. På hvilke måter bruker lærerutdannere digital teknologi når de underviser i kunst- og designfag i Uganda?*
- 2. Hvordan utvikler lærerutdannere i kunst- og designfag sin digitale kompetanse i lærerutdanningsinstitusjoner i Uganda?*
- 3. Hvilke utfordringer møter lærerutdannere når de underviser kunst- og designfag med digital teknologi i Uganda?*

Med utgangspunkt i teoretiske begreper fra van Dijk (2005), Mishra og Koehler (2006) ble data analysert og presentert i henhold til de tre forskningsspørsmålene og dokumentert i tre forskningsartikler (*referert til i denne avhandlingen som henholdsvis artikkel I, II og III*), som hver adresserer ett av forskningsspørsmålene.

Funnene i artikkel I viser at lærerutdannere av og til bruker digital teknologi til å undervise i kunst- og designfag. Bruken kan karakteriseres som enkel og lite kreativ. Dette kan tilskrives utilstrekkelig tilgang til digitale ressurser (maskinvare, programvare og internett), begrenset digital kompetanse og begrenset kunnskap om pedagogisk bruk av digital teknologi i kunst- og designfag. Funnene viser videre lærerutdannernes begrensede bevissthet om forholdet mellom teknologisk-, pedagogisk- og fagkunnskap (TPACK) i undervisningen i kunst og designfag. Mangelen på TPACK blant lærerutdannere forklarer noe av den begrensede kreative bruken av digital teknologi i undervisningen i kunst- og designfag i Ugandas lærerutdanningsinstitusjoner.

Funnene i artikkel II indikerer at lærerutdannere i kunst- og designfag utvikler digital kompetanse gjennom både formelle og uformelle tilnærminger. De formelle tilnærmingene inkluderer kompetanse tilegnet gjennom den grunnleggende lærerutdanningen og gjennom etter- og videreutdanning, mens uformelle tilnærminger inkluderer kollegasamarbeid, egenlæring og

repetisjon. Studien viser at den digitale kompetanse som lærerne oppnådd gjennom formelle tilnærminger ikke var knyttet spesifikt til undervisningen i kunst- og designfag, noe som gjorde det utfordrende og vanskelig å bruke denne kompetansen i klasseromspraksis. Derimot viser funnene i denne studiet antyder at lærerutdannere utvikler en begrenset digital kompetanse, nødvendig for praktisk bruk i klasserommet, gjennom uformelle tilnærminger.

Funnene i artikkel III avslører en rekke motivasjonsutfordringer (knyttet til negative holdninger, mangel på selvtillit, mangel på tid, begrenset digital kompetanse og frykt for tap av faglig kreativitet) i tillegg til utfordringer knyttet til materiell tilgang, slik som; tilstrekkelig tilgang til digital teknologi, upålitelig strømforsyning, teknologiske feil og tilstrekkelig teknisk støtte. Artikkel III diskuterer videre alternative strategier som brukes av lærerutdannere under slike forhold, slik som kollegastøtte, kursvirksomhet, improvisasjon, lobbyvirksomhet for teknisk og økonomisk støtte, og bruk av egne digitale verktøy (BYOD-Bring Your Own Device) for å takle eksisterende utfordringer.

Generelt sett, viser funnene i denne studien at lærerutdannelsens digitale kompetanse forblir operasjonell og ikke fagspesifikk for undervisningen i kunst- og designfag, og dermed er utilstrekkelig og begrenset for anvendelse praktisk undervisning i kunst- og designfag. På grunn av lærernes motivasjonsmessige og materielle utfordringer, i tillegg til begrenset bevissthet om forholdet mellom teknologisk-, pedagogisk- og fagkunnskap, viser denne studiet at lærerutdannere bruker digital teknologi på en svært enkel og lite kreativ måte i deres undervisning i kunst- og designfag i Uganda.

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Article I

Tusiime, W. E., Johannesen, M., & Guðmundsdóttir, G. (2019). The dilemma of teaching with digital technologies in developing countries: Experiences of art and design teacher educators in Uganda. *Nordic Journal of Comparative and International Education (NJCIE)*, 3(2), 55-71. <https://doi.org/10.7577/njcie.3313>

Article II

Tusiime, W.E, Johannesen, M. & Gudmundsdottir, G. (2019). Developing Teachers' Digital Competence: Approaches for Art and Design Teacher Educators in Uganda. *International Journal of Education and Development using ICT*, 15(1). http://ijedict.dec.uwi.edu/viewissue.php?id=53#Refereed_Articles

Article III

Tusiime, W. E., Johannesen, M. & Gudmundsdottir, G. B. (2020) Teaching art and design in a digital age: challenges facing Ugandan teacher educators, *Journal of Vocational Education & Training*, 72(2). DOI: [10.1080/13636820.2020.1786439](https://doi.org/10.1080/13636820.2020.1786439)

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1 Introduction

Globally, technological advancements are changing the operations of teacher education (UNESCO, 2015). Several countries have embarked on the integration of digital technologies in teacher education programmes (UNESCO, 2005; Unwin, 2005; Farrell & Isaacs, 2007). Consequently, access to technology is becoming increasingly common, according to the number of users globally, although there is a prevailing disparity in the skills and opportunities to use technologies and in the relevance of content (Gudmundsdottir, 2010a; van Dijk, 2005). In some countries, an analysis of the curriculum for teacher education indicates that digital competence is integrated to a limited extent in the curriculum documents and that there are variations between the different institutions in terms of technology integration (Insterfjord, 2014). Yet, in the present, new technologies are replacing some of the things that teachers do around the globe (Trucano, 2016). This requires that educators take on new, often times more sophisticated, duties and responsibilities. Trucano (2016) observes that, ‘teachers who don't use technology will be replaced by teachers who do and in places where there are currently ‘no’ digitally competent teachers, technology can help in some very useful ways to, in part, overcome this absence’ (p.8). It is thus incumbent upon countries and teacher education programmes to adhere to the global need to develop teachers’ digital competence (Freeman & Hawkins, 2017; WorldBank, 2016) in particular to integrate technologies in their teaching practices and in teacher education programmes.

1.1 Teacher Education and technology use in Uganda

Uganda, like most countries in the world has for more than a decade realized the technological need for education and commenced on strategies that emphasize the integration of technology for pedagogical purposes in general, vocational and teacher education programmes (MoES, 2008). The concerns about digital technologies and their importance in Uganda’s education gave birth to the development of ICT policies (Uganda, 2014a) and strategic plans (Uganda, 2017; Uganda, 2015; Uganda, 2014b; Vision 2040). Similarly, Wamakote (2010) reported that, over the years the Ugandan government through the Ministry of Education and Sports (MoES) in partnership with other agencies have supported the integration and development of teachers’ digital competences through a number of ICT initiatives. These initiatives have focused on equipping schools with computers and associated hardware/software, provision of internet connectivity,

equipping teachers and teacher educators with relevant digital skills for integration in the teaching process as well as the development and selection of digitized pedagogical content (Uganda, 2014a; Matunga, 2007). Notable among these initiatives are; The UNESCO-China Funds-in-Trust Project (UNESCO-CFIT project) - “Enhancing Teacher Education for Bridging the Education Quality Gap in Africa” (Uganda, 2014c); UNESCO Creating learning networks for Africa (Luwangula, 2011) ; the Microsoft Partners in Learning Program, SchoolNet, Connect-ED, Global Teenager Program, Curriculum Net, U-Connect, NEPAD e-schools initiative, I-Network Uganda (Farrell, 2007); Cyber-schools technology solutions (CSTS) program and Computers for Schools – Uganda (Wamakote, 2010), MTN Project: Skilling for the future (S4F) (MTN, 2016).

However, Luwangula (2011) observes that while there have been many initiatives over the years to introduce and increase access to technologies into schools in Africa, many have failed to live up to their aspirations because they have been top-down and supply led with insufficient attention being paid to the involvement and training of teachers. In Uganda, Wamakote (2010) contends that, information on the actual impact of these initiatives is scanty in the country and that hardly any well documented evidence to reveal whether the implementation of such initiatives has had any impact on the teachers’ digital knowledge and competences. This situation questions teachers and teacher educators’ competence to integrate digital technology in their pedagogical practices thus the need to examine teachers’ digital competences in Uganda’s teacher education.

Despite the numerous initiatives taken by different stakeholders in the education sector to integrate technology in Uganda’s education, studies in Uganda (Nakintu & Neema-Abooki, 2015; Andema, Kendrick, & Norton, 2013; Hennessy, et al., 2010; Anthony, 2013; Andema S., 2014) continue to reveal that, there appears to be a gap between the technology available in classrooms and teachers’ digital competences to use this technology for pedagogical purposes. In particular, the extent to which educators are taking advantage of the extended digital opportunities, how and if digital technologies are used in the classroom and incorporated in the training curricula for Art and Design teacher education is unclear. In addition, the question of if there are other challenges, beyond material access (van Dijk, 2005) that hinder the use and contribute to a more digital gap is not addressed. While research in Uganda shows that teachers often fail to demonstrate ability to use the available digital tools in the teaching process

(UNESCO, 2014; MoES, 2008), such research is still limited and does not include a focus on teacher educators' digital competence in teaching art and design subjects. Consequently, there is need to intensify art-specific ICT training, the fact that technology is redefining art itself – its themes, tools and vocabulary (Wood, 2004). As with other subjects, technology is changing the subject of art and design; not just the way it can be taught or learned. As such, art and design teachers require even more digital competences to effectively teach in the 21st century digital landscape. Upon this background, the next section presents the study's aim and research questions.

1.2 Aims and research questions

The main aim of present study is to contribute with insights into teacher educators' digital competence in teaching Art and Design subjects in teacher training institutions (TTIs) in Uganda. Accordingly, although the use of digital technology in teaching is considered critical in Uganda's education sector (Uganda, 2014a), studies (Nakintu & Neema-Abooki, 2015; Andema, Kendrick, & Norton, 2013; Nakazibwe, 2011; UNESCO, 2006) in Uganda's teacher education continue to indicate that, majority of the teachers do not possess hands-on digital pedagogical skills. In addition, there is limited scholarly evidence on the development of teachers' digital competence in teacher education programmes like art and design. Therefore, this study sought to contribute knowledge on teacher educators' pedagogical use of digital technology in the field of art and design education in Uganda. To achieve the above goal, the study was guided by the following research questions (RQ):

RQ1: In what ways are teacher educators using digital technology when teaching art and design in Uganda?

RQ2: How do art and design teacher educators develop their digital competence in Teacher Training Institutions in Uganda?

RQ3: What challenges do teacher educators encounter when teaching art and design with digital technology in Uganda?

On the basis of these research questions, three research articles (*referred to in this thesis as; Article I, II and III respectively*) each addressing one of the RQs comprise of this thesis.

Briefly, Article I sought to understand how TEs use digital technologies in teaching A&D in a developing country. Article II sought to understand how A&D TEs develop digital competences in TTIs in Uganda, whereas, Article III explored the challenges that A&D TEs in Uganda encounter when teaching with digital technologies and examined how TEs cope with these challenges. A summary of the major findings from each of the articles are later presented in chapters 5 (5.1, 5.2, 5.3) whereas the discussion and general contributions of the study findings are presented in chapter 6 of this thesis. However, a detailed presentation and discussion of general findings can be found in each of individual research articles in *Appendices 1, 2 and 3* of this thesis.

1.3 Outline of the thesis

This PhD thesis consists of six chapters that contextualize the study, clarify the theoretical perspectives, describe the methodology of the research process and discuss the overall study findings and their contribution based on the RQs that are answered in the three research articles. Following the order of presentation in this thesis, Chapter 1 presents the general background to the study including the aim and the key research questions. Chapter 2 presents the knowledge status (literature review) as regards the theme of this study by the three research questions. Chapter 3 discusses the theoretical perspectives underpinning the study whereas, Chapter 4 describes the methods employed to conduct the research. Specifically, this chapter discusses issues related to data collection methods, data analysis, questions of validity and reliability, and ethical considerations that are relevant to the study. Chapter 5 presents a summary of the findings generated the three articles upon which the thesis is built. Lastly, Chapter 6 discusses the main findings in view of the three RQs, provides concluding remarks and reflects on the study's main contributions, implications, limitations, and provides recommendations and suggestions for further research.

2 Literature review

This chapter, based on recent scientific studies, discusses the concept of teachers' digital competence (TDC) as the main term used in this study. Guided by the research questions, the section mainly draws focus on how educators use digital technologies in teaching art and design, how educators develop digital competence for teaching in art and design teacher education and the challenges educators face in teaching with digital technology in teacher education. However, other related issues such as justification for reviewing literature, description of how the reviewed literature was sourced (search method) and decided upon are discussed in this chapter.

2.1 Why review the literature?

Drawing on insights from scholars debating literature review (Boote & Beile, 2008; Thomson, 2012; Clarence, 2017) the aim of this literature review is not only to provide a general overview of recently published research in the field under investigation but to contribute to the discussion and its relationship to the related research area, its key concepts and lines of argument (Thomson, 2012; Clarence, 2017). Thus, this chapter will critique the literature, wherever necessary, with the purpose of advancing the research field forward. Of particular importance and focus is on the contextualization of the study's main theme guided by research questions (RQs) presented earlier in the previous chapter.

2.2 Search method

The literature review was approached through systematic data-gathering strategies (e.g. Gough, Thomas, & Oliver, 2012a; Gough, Thomas, & Oliver, 2012b). A search for relevant articles was conducted via databases; Academic Search Premier, Academic Search Ultimate, ERIC and Education source with some additional hand-searched articles. The searches aimed mainly at capturing published empirically-based research articles on teachers' digital competence in English language and in peer-reviewed journals. The key searches for the relevant literature were confined to the periods 2006–2019, and were performed in September 2018, with follow-up searches in September 2019. In addition, the articles included in this review chapter are not only (but are mainly) empirically-based, related to art and design education and/or teacher education and guided by the study's RQs. However, most importantly, the concept of teachers' digital

competence is contextualized in this chapter. The criteria for article inclusion and exclusion are outlined in *table 1* inspired by Røkenes and Krumsvik (2014).

Table 1: Inclusion and exclusion criteria (table inspired by Røkenes and Krumsvik, 2014)

	Included	Excluded	Rationale
Databases	ERIC, Academic Search Premier, Academic Search Ultimate, Education Source	All other databases	
Time frame	2006 – 2019	Articles published before 2006 and after 2019	Relevance to the current context of the PhD study.
Publication type	Peer-reviewed articles.	Other formats (e.g. Books and book chapters, conference proceedings, short papers, grey literature (e.g., reports), editorials, book reviews, e.t.c.)	Ensure scientific quality and decrease the risk of inappropriate conclusions
Focus	Empirical studies with primary focus on technology use in the classroom/developing country/Africa/Uganda; challenges related to technology use in the classroom /school /college environment; developing educators digital competence, digital literacy, computer literacy, and media literacy in teacher / Art and Design education.	Articles focusing on other aspects	Relevance to the current PhD study's guiding questions.
Language	English	Other languages	Published for international audience
Target population	Articles focusing on teacher educators, educators, teachers, student teachers, pre-service teachers, mixed in-service and student teachers	Articles focusing on pupils or other populations (e.g., nurses, seniors, special needs, etc.)	Relevance to the current context of the PhD study.
Target teaching level	Primary school, lower and upper secondary school, high school, college and university or higher education	Elementary School, Kindergarten, Pre-School, Special Education, Adult Education /Adults Professional Development	Relevance to the current context of the PhD study and its focus on research on teacher education

Based on the above criteria, the database searches resulted in 22 hits as shown in *table 2*, while manual searches resulted in 103 hits, adding up to a total of 125 hits. After manually

screening the abstracts, 87 articles were identified based on inclusion and exclusion criteria and included for the review.

Table 2: Results from database searches

Search	Query	Limiters/Expanders	Last Run Via	Results
S4	S1 AND S2 AND S3	Limiters – Full Text, Peer reviewed, 2006-2019 publication, English; academic journal. Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Ultimate; ERIC; Education Source	22
S3	"Art education" OR "Art and design" OR "Art* and craft*"	Limiters – Full Text, Peer reviewed, 2006-2019 publication, English; academic journal. Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Ultimate; ERIC; Education Source	7,801
S2	"Teacher educat*"	Limiters – Full Text, Peer reviewed, 2006-2019 publication, English; academic journal. Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Ultimate; ERIC; Education Source	73,636
S1	(Digital OR ICT OR Computer OR technological) AND (competence OR skill* OR literacy)	Limiters – Full Text, Peer reviewed, 2006-2019 publication, English; academic journal. Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database – Academic Search Ultimate; ERIC; Education Source	39,557

2.3 Contextualizing teacher educators' digital competence

This study sought to contribute with insights into teachers' digital competence (TDC) in the teaching of Art and Design subjects in teacher training institutions (TTIs) in Uganda. For more than a decade, there has been increasing focus on digital competence in educational reforms, policies, and frameworks in different parts of the world. (European Commission, 2007; Ferrari, 2012, 2013). Consequently, the concept 'digital competence' has broadly been defined as, the set of knowledge, skills, attitudes, abilities, strategies, and awareness that are required by educators when using digital technology to perform educational related tasks such as; problem solving, communication, manage information, collaborate, create and share content, and build knowledge (Ferrari, 2012). Ferrari further asserts that, digitally competent users should be able to perform tasks, "effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, and socialising" (Ferrari, 2012, p. 30). In the context of this study, 'digital technology' relates to Information and Communications Technology (ICT) and includes all types of electronic devices and applications that process, store and use digital content in teaching and learning of art and design, for example; personal computers and accessories, high-definition television sets, cellular telephones, audio / video recorders, radio, compact disc players, interactive white boards, internet and software applications.

In view of the above understanding, Johannsen et al, (2014) observe that, teachers' digital competence in a broad perspective includes three aspects: "teaching *of* ICT; teaching *about* ICT and teaching *with* ICT" (p.301). In the present study, focus is put on the later ("teaching with ICT") which is concerned with arranging for student learning with digital tools (Johannsen et al, 2014). In the context of this study, I argue that not only teacher educators require the basic hands-on digital competence for pedagogical purposes but rather a comprehensive set of both 'soft' and 'hard' skills that can enable an educator planning to teach with technology to; access and produce information, create content, disseminate and share e-learning content towards improving, and managing the quality of teaching and learning in art and design teacher education. Moreover, Gudmundsdottir (2010b) emphasizes that having both basic digital skills, such as being able to open, save, and write a document, as well as the competence required for using the opportunities digital tools offer for a creative learning environment (such as to evaluate quality of information, retrieving and producing new knowledge) and other less quantifiable

elements. Hatlevik & Christophersen (2013), posit that the effectiveness of teaching with digital tools in schools may partly rely on one's digital competence, or their abilities and skills to use technology and digital environments. Moreover, Mwawasi (2014) suggests that, it is necessary to teach teachers how to apply information and communication technologies (ICT) to their teaching practice rather than to simply teach teachers basic ICT literacy without applying it to pedagogy. Therefore, in the present study, although Art and Design (A&D) teacher educators need to be taught about basic digital technology, they also need to know how to apply such technology to their teaching practices ('teaching with ICT'). This is meant to enable educators to use technology appropriately and effectively in the classrooms. As such, educators are able to help their learners live and work successfully in an increasingly complex and information-driven society (Donahoo and Whitney, 2006). In the next sections (2.4 – 2.6), based on the order the study's RQs have been organised earlier in chapter 1, I present and discuss literature related to how teacher educators use digital technologies, how educators develop digital competences to teach and the challenges encountered by educators while teaching with digital technologies in general teacher education and A&D education in particular.

2.4 Teaching with digital technology in teacher education

In recent years, the impulse to embrace digital technology and its potential to advance teaching and learning in art and design classrooms and teacher education programmes has been a continuous endeavour around the world (Lin, 2011; Bastos, 2010; Gilakjani, Leong, & Ismail, 2013). Gilakjani, Leong & Ismail (2013) for instance, point out that, there are many benefits in using technology in educational settings. They assert that the adoption of digital technologies in the teaching-learning processes makes the learner more interested about the subject being taught, and provides opportunity to learn in non-traditional ways. Similarly, Art and Design (A&D) educators across the globe have engaged in studies related to the preparation of teachers' digital competences including teacher perceptions of working with technology in the classroom (Cress, 2013; Roland, 2010; Phelps & Maddison, 2008). In addition, studies have focused on the implementation of digital media in art and design teaching practice (Marner & Örtégren, 2013; Shin, 2010) and identification of the key factors and obstacles of art and technology integration (Black & Browning, 2011). Certainly, A&D educators increasingly have adopted new digital

technologies into their pedagogy since the beginning of the 21st century to support the creation and making of innovative teaching and learning practices (Lemon, 2015).

Lemon (2015) posits that, digital technology is expanding the teaching and learning possibilities to support shared visions, innovative art practices and high levels of engagement in meaning making to understand the world for both educators and students. Lemon further adds that, art educators with greater access to digital technologies especially in the developed world can build students' digital capacity to present, research, process, and communicate their art making. Similarly, McKnight, et al., (2016) study results suggest that, digital technology improved access for teachers as well as for students, to more up-to date learning resources and to materials at anytime and anywhere. Further the authors observed that digital technology enhances communication and feedback between teachers, students and parents, technology decreased the amount of time teachers spent on tasks, and that technology had the potential to shift the traditional roles of teachers and students both within and outside the classroom. Magambo (2007) concurs and further reports that, new technologies challenge the traditional conceptions of both teaching and learning and that technology is transforming the present teacher-centred pedagogy and text-bound classrooms to more effective learner-centred interactive knowledge environments.

In developing continents like Africa, Appiah & Cronjé (2012) observe that the introduction of the internet and other sophisticated digital technologies like computer and software packages in art and design education in the recent past have seen changes to both pedagogy and students' learning respectively. In particular, computer technologies are slowly changing the pedagogy of art and design subjects such that both educators and students spend part of the teaching-learning time on the computer developing sketches for the design process. Likewise, over the years studies (Brinkerhoff, 2006; Mayra & Cowan, 2012) have indicated that teachers have substantially adopted technology for pedagogical purposes in different education fields including A&D teacher education. Accordingly, this level of technology adoption may be related to the availability of digital tools especially in the developed world.

However, despite the opportunities digital technologies offer, recent studies in art and design and teacher education (Onwuagboke, Singh, & Fook, 2015; Radclyffe-Thomas, 2008; Kotrlik & Redmann, 2009) reveal that, there are also just as many educators who do not consider or use digital technologies especially in resource constrained institutions of learning (Tulinayo,

Ssentume, & Najjuma, 2018). Brinkerhoff (2006) observed that teachers often fail to adopt technology use in their classroom practice due to barriers such as institutional and administrative support, training and experience, attitudinal or personality factors, and resources. In Africa and some parts of the developing world, Appiah & Cronjé (2012) observe that, art educators still train design students to the tradition of going through thumbnail sketches in their sketchbooks before transferring the sketches to the computer for design work. The studies (Onwuagboke, Singh, & Fook, 2015; Phelps & Maddison, 2008) further indicate that, teacher educators do not possess sound technological and pedagogical competences and in some cases lack access to digital infrastructure.

Although, there is hardly any documented study on how teacher educators use digital technologies in art and design education in Uganda, for which this study is contextualized, other studies in teacher education have reported the limited use of digital technology in Uganda's teacher education programmes (Bagarukayo, 2018; Nakintu & Neema-Abooki, 2015; Andema, Kendrick, & Norton, 2013). Further, these studies report the inability of teachers to use the available digital resources as instructional tools due to inadequate digital skills. Apau (2017) concurs and notes that many teacher education programmes focus only on the development of sound pedagogical skills and competencies to meet the varying needs of learners in the classroom. Apau suggests that, teaching in today's classrooms should not only be dependent on the content and pedagogical knowledge of the teacher as it were but also, on the technological knowledge and the teacher's ability to use technologies for instructional-related purposes in and out of the classroom. Instead, teacher educators must ensure teacher trainees graduate from their institutions of training with some knowledge domains that would help them to integrate technology, pedagogy and content in their teaching.

Similarly, for Uganda, Andema, Kendrick, & Norton (2013) recommend that, the ICT policy for education should address teachers' use of digital technology across diverse teacher education programmes through relevant training in the use of digital technologies in the classroom. The authors add that, innovations such as the eGranary portable digital library should be availed in poorly resourced teacher education institutions.

2.4.1 Summing up

It can be noted from the literature presented in section 2.4 that the adoption of digital technologies for pedagogical purposes in teacher education programmes like A&D in the present day can not be underscored due to an enormous number of benefits. However, studies (Aladejana & Idowu, 2009; Abass, 2011; Appiah & Cronje, 2013) over a period of time have also indicated that the adoption of technology in teaching has the tendency of hindering learning if inappropriately used in the classroom. This could be as a result of inadequately trained teachers to use digital resources (Gilakjani, Leong, & Ismail, 2013) or simply lack of adequate digital resources as earlier highlighted in the previous section. Therefore, this underscores the fact that technology alone may not be able to account for the needed educational transformation expected in present day classroom without a well-planned and supportive digital environment. In the context of this study for instance, the adoption of technology for pedagogical purposes in Uganda is still considered to be at the infancy stage (Uganda, 2014a). As such there is scanty literature with a focus on the development of teachers' digital competence and use of technology for pedagogical purposes in teacher education programmes like art and design. Consequently, this PhD study will contribute with new empirical evidence to guide policy makers, educators and other stakeholders on how to mitigate some of the gaps in order to fully appropriate technology in teacher education programmes and more importantly art and design.

The next section presents literature on some approaches teacher education programmes have employed to develop teachers' digital competences to integrate technology in their pedagogical practices in the classroom.

2.5 Developing Teacher's Digital Competence (TDC)

Developing TDC in teacher education does not solely involve educating teachers how to understand and use various emerging technologies that are relevant to their professional practice (Lund et al, 2014). With respect to Uganda's teacher education, one would be tempted to assert that the opposite is true with this statement on the account that the efforts put in place by different stakeholders to develop teachers' digital competences seem not to yield the expected results (Wamakote, 2010). Lund and his colleagues submit that, developing TDC involves the ability to make teachers capable of using digital technology and learning resources in productive

ways to transform their knowledge into discipline-specific didactics, classroom management, and assessment of how students make productive use of available digital resources.

In Uganda where the use of digital technology in teacher education is in its earlier stages of integration, often times, teachers fail to relate knowledge of what they have learnt through training on the use of digital technologies to their own practice (Uganda MoES, 2008). Therefore, teacher education programmes such as art and design education need to adopt alternative approaches that would bridge the gap between theory and practice during training with digital technology to enable newly qualified teachers acquire the relevant digital competences for the 21st century. Some of these approaches are discussed in the following paragraphs.

Collaborative or co-operative learning approaches have for years been used in teacher education as environments in which students and teachers develop competences by engaging in a common task in which each individual depends on and is accountable to each other. Røkenes & Krumsvik (2014) note that, in technology training situations, two or more student teachers work together to maximize their own and other's learning. Collaborative learning being an active and constructive process (Laurillard, 2009) enables student teachers to easily acquire new knowledge and competences, which later are used to create new meaning. In countries like Uganda where access to digital technologies like computers and the internet is still reported by teacher educators (Andema, Kendrick, & Norton, 2013; Andema, 2009) as being limited, collaborative learning still becomes a suitable approach for developing teachers digital competence. Most times, student teachers are subjected to group and team assignments during technology lessons due to limited computers. Through such an approach, the students learn from each other and the teacher also can learn from the students through their presentations and practical tasks hence developing both their competences.

According to Mishra & Koehler's (2006) TPACK model, the teacher needs technological knowledge, as well as knowledge about content and pedagogy. In addition, they need an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that student teachers face; knowledge of students' prior knowledge and theories of epistemology; and

knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones.

The compound knowledge of issues raised from the intersections between technology, pedagogy, and content in the TPACK model is instrumental in describing what teachers need to know to effectively integrate technology into their teaching practices as well as develop their digital competences. Though Uganda has a Draft ICT in Education Policy that demands for the development ICT-enabling curriculum in education, the integration of ICT-subject based curriculum into teacher training programmes is still a concern (Uganda, 2014a). Instead, ICT as a subject has been introduced at secondary education, teacher training institutions and is offered at some of the universities. Thus, there is need for teacher education programmes in Uganda to adopt the TPACK model as an approach in designing ICT curriculum for specific subjects. Adopting this model could potentially have an impact on the type of training more so to the development of teachers' digital competences in Uganda.

Research indicates that teachers' experience and continuous practice with technology from teacher education programmes influences how they later choose to use technology in their teaching (Agyei & Voogt, 2011; Drent & Meelissen, 2008). When teachers are properly trained in the pedagogical use of digital technology and continue to practice, such an experience could enhance their digital competences. In Uganda where teacher education programmes are commonly criticized for their failure to provide teachers with the necessary hands-on training on how to utilize digital technologies as pedagogical tool (Uganda, 2014b; Mutonyi & Norton, 2007), this approach could provide teachers with the necessary experiences of how to utilize digital technologies in a teaching practice.

Blended learning or a multimedia instruction is also an approach that can be adopted in Uganda's teacher education to help teachers develop their digital competences. It involves a combination of face-to-face (F2F) traditional pedagogies and online learning pedagogies where digital technologies play a central role in blended learning (Gudmundsdottir & Vasbø, 2017; Bernard, Borokhovski, Schmid, Tamim, & Abrami, 2014; Keengwe & Kang, 2013; Garrison & Vaughan, 2008). In their study in Norway, Gudmundsdottir & Vasbø (2017) indicate that, students who actively use the online modules report that the teacher education program enhances the development of their professional digital competences (PDC), whereas those who are less

active state that the teacher education program is less valuable in contributing to the development of their PDC.

In Uganda like most developing countries, blended learning is rather a recent approach and a few teacher training institutions are at the peripheral of integrating it into the pedagogical processes. Through Active Teaching and Learning (ATL) an on-going program in selected teacher training institutions sponsored by the Belgium government, blended learning is employed as an approach in equipping technical, secondary and primary teachers with digital skills for pedagogical purposes (Uganda MoES, 2016). It involves training of student teachers through the use and combination of both traditional face-to-face classroom pedagogies and online instructional resources to create meaning through electronic mediums such as with video, animations, diagrams, photos, illustrations, written and spoken text.

Through such modes, Mayer, Lee, & Peebles (2014) note that, blended learning makes the teaching and learning process interactive as teacher students engage in various multimedia activities from where they acquire varying knowledge and competences through constant interactions with digital technologies (computers, videos, animation and the internet) and the task content.

Subsequently, another significant approach to developing teachers' digital competence is student-active learning approach or "learning by doing" which according to (Røkenes & Krumsvik, 2014) involves a shift of pedagogical control from the teacher to the individual where learners are supported, actively engaged, and involved in meaning making and the learning process. Røkenes & Krumsvik note in their study that, student teachers learned to integrate technology for their future teaching by actively engaging in learning and meaning-making processes through experiencing, interacting with, and creating classroom-related digital resources. Similarly, in Uganda's teacher education institutions, teacher students particularly in practical areas that require them to perform tasks with the aid of digital technology may find this approach more appropriate form of developing their competences. In their study, Andema, Kendrick, & Norton (2013) indicate that, majority of the teachers that were part of their study, had learnt to use the computer through friends who trained them informally from an Internet café in town or homes and later practiced on their own. Thus, teacher education programmes in Uganda need to underscore the importance of informal networks that are a hub for learning by doing approach.

Lastly, demonstration or modeling is an essential teaching approach that has been traditionally used globally in teacher education for many years to develop skills in student teachers (Dorgu, 2015). Though the approach is criticized for hindering creativity and originality of the students as they try to do exactly the same way as their teacher did (Dorgu, 2015), this approach develops interest in the learners and motivates them for their active participation in the teaching learning process. According to Dorgu, the approach requires that learners are able to illustrate, demonstrate, or perform certain skills using their manual dexterity, hence making it a more student activity based approach. In the process of teaching with this approach, Lunenberg, Korthagen, & Swennen, 2007 cited in Røkenes & Krumsvik, 2014 state that, teacher educators, in-service teachers, mentors, and peers promote particular practices and views of learning through “intentionally displaying certain teaching behaviour”, which play an important role in shaping student teachers’ professional learning. In countries like Uganda, where the available teaching resources like computers and related instructional materials such as text books do not match the large numbers of learners in classrooms (Nakabugo, Opolot-Okurut, Ssebbunga, Maani, & Byamugisha, 2008), demonstration approach can be resourceful for training student teachers in the use of technology through explicit demonstrations with the few available digital resources such hardware and software to groups of students. This could bridge the gap between theory and practice as teacher students develop digital competences through demonstrations in their small groups.

2.5.1 Summing up

Overall, the body of knowledge presented in section 2.5 reflects a few approaches to developing teachers’ digital competence (TDC) in teacher education. However, there is limited evidence on the development of TDC in teacher education in Uganda and in the field of art and design in particular. This knowledge gap, in addition to inadequate access to digital technologies, calls for further studies to establish how TDC is developed in Uganda’s teacher education programmes. In the next section, I present and discuss literature related to the challenges educators encounter in the process of teaching with integrating digital technologies in their classrooms.

2.6 Challenges in teaching with digital technologies.

For more than a decade, a considerable amount of literature has continued to document concerns surrounding the challenges educators encounter in the process of integrating digital technologies

in their classroom teaching across the globe (Mfaume, 2019; Hatlevik & Gudmundsdottir, 2013; Hew, 2007; Park & Ertmer, 2008) thus, limiting the potential of technologies to improve student's learning in the twenty-first century (Delacruz, 2009). Tulinayo, Ssentume, & Najjuma, (2018) noted in their study that, one of the limiting factors for the use and acceptance of digital technologies is the limited access to digital technologies in institutions of learning. In some countries like Uganda for which this study is contextualized, this challenge of limited access is attributed to the high numbers of students as compared to the available digital technologies and the limited institutional computer laboratory space (Nakabugo, Opolot-Okurut, Ssebbunga, Maani, & Byamugisha, 2008).

Although computers and other technologies have become increasingly accessible resources for educators to use in their teaching activities, most teachers are still unable to integrate such technologies in their teaching and learning processes (Oguzor, 2011). Oguzor (2011) further observes from his study findings in Nigeria that, while educators tend to integrate and implement computer technology within educational settings, approximately half of the students are not able to use computers. The number of computers installed in the schools is deficient in which one computer is shared on average by as many as 50 students. This implies that a student's learning could be compromised and the intention of teaching with digital technologies may not help to achieve desired outcomes.

Studies conducted in developing countries (Al-Azawei, Parslow, & Lundqvist, 2016; Bonsu, Duodu, Ansere, & Djang-Fordjour, 2013; Madlela, 2015; Andersson, 2008) indicate that even though computers and other technologies are common, developing countries are not enjoying their benefits due to certain challenges. For instance, Bonsu, Duodu, Ansere, & Djang-Fordjour (2013) study findings in Ghana revealed that a few educators were able to use computers in teaching while majority of the educators were still comfortable using traditional ways of teaching (chalk and blackboard and handouts dictating notes). This is attributed to inadequate access to technologies like computers, inadequate financial support for purchasing the technology, lack of training for educators and inadequate motivation for educators to adopt digital teaching tools. Similarly, Madlela (2015) noted from his study findings in South Africa that, there was an existence of threats that inhibited educators from utilizing ICT opportunities to implement its teaching practice programmes. Such threats included; lack of adequate and up to date digital infrastructure e.g. computers for both educators and students; teachers and students

didn't have ICT skills and knowledge; university curriculum had not yet incorporated ICT into teacher training programmes and no technical personnel to set up relevant digital infrastructure with modern and up to date hardware and software for the teaching practice.

In addition, Al-Azawei, Parslow, & Lundqvist (2016) in their study that sought to identify the main challenges in e-learning adoption in Iraq reported that; low internet bandwidth, insufficient financial support, inadequate training programs, lack of technical support, lack of ICT infrastructure, ambiguous plans and policies, frequent electricity shortage; insufficient digital literacy, lack of awareness, interest, and motivation to be among the challenges to technology adoption in Iraq's public universities. The challenges identified through their study are closely related to the findings reported from different studies conducted in other developing countries such as in Sri Lanka (Andersson, 2008), Tanzania (Mfaume, 2019), Kenya (Tarus, Gichoya, & Muumbo, 2015) and Uganda (Farell, 2007).

2.6.1 Summing up

To sum up, it can be noted from the discussion in 2.6 that the opportunities available for educators when they integrate digital technology in their teaching practice can greatly be impeded by challenges sometimes which are beyond a teacher's control. As earlier noted for the case of Uganda for which this study is contextualized in section 1.2 of this thesis, the existing gap between the digital technology available in classrooms and teachers' digital competences to use this technology for pedagogical purposes will continue to widen if teacher education programmes such as art and design don't continuously address the challenges presented. In the next chapter, I present the theoretical underpinnings used in this study.

3 Theoretical perspectives

In view of technology integration in teacher education, considerable research has documented the various models and theoretical frameworks to guide the integration of digital technology into the school community and the principles for effective use of technology in teacher education (Ng, Miao, & Lee, 2009; UNESCO, 2008; Engida, 2011; Graham & Jenny, 2010; Mwawasi, 2014, Mishra and Koehler, 2006). However, the theoretical views guiding this study are based on vanDijk's (2005) resources and appropriation theory (RAT) of the diffusion, acceptance and adoption of new technologies. In addition, perspectives from the TPACK framework (Mishra & Koehler, 2006) that builds on Shulman's (1986) descriptions of Pedagogical Content Knowledge (PCK) are included to supplement the RAT. While the RAT addresses circumstances surrounding the users' ability to adopt digital technologies in day-to-day life activities, the TPACK framework specifically presents a set of knowledge domains necessary for all teachers to effectively integrate digital technologies in the pedagogical process. Thus, in the present study, the two theoretical perspectives are used to guide the research process and illuminate the findings on the basis of research questions as elaborated further in the ensuing sections.

3.1 The Resources Appropriation Theory (RAT)

The resources and appropriation theory (RAT) was advanced by van Dijk (2005) and has since then been used to describe the multi-faceted digital divide (van Dijk, 2006; Ragnedda & Muschert, 2013), a complex and dynamic phenomenon that for years has existed in the information society across the globe (van Dijk & Hacker, 2003). This theory is a version of structuration theory (resources) and acceptance theory (appropriation) (Van Dijk J. , 2017). The core argument of the theory sets particular relationships between four circumstances connected in a process of creating more or less digital inequality when using digital technologies. Van Dijk (2005: 15) described the relationships in the following statements (see also figure 1):

1. Categorical inequalities (*personal & positional*) in society produce an unequal distribution of resources. The *personal* categorical inequalities are age (young/old), gender (male/female), race/ethnicity (majority/minority), intelligence (high/low), personality (extravert/introvert; self-confident/not self-confident), and health (able/disabled). The *positional* categorical inequalities include labor position (entrepreneurs/workers;

management/employees; employed/unemployed), education (high/low), household (family/single person), and nation (developed/developing). According to RAT, personal and positional inequalities produce different resources (van Deursen & van Dijk, 2019). For example, resources that are frequently considered in digital divide research, albeit under other labels such as economic, social, and cultural capital, include possession, income, and access to a social network (for a review of inequalities between persons).

2. An unequal distribution of resources causes unequal access to digital technologies.
3. Unequal access to digital technologies also depends on the characteristics of these technologies.
4. Unequal access to digital technologies brings about unequal participation in society.
5. Unequal participation in society reinforces categorical inequalities and unequal distribution of resources.

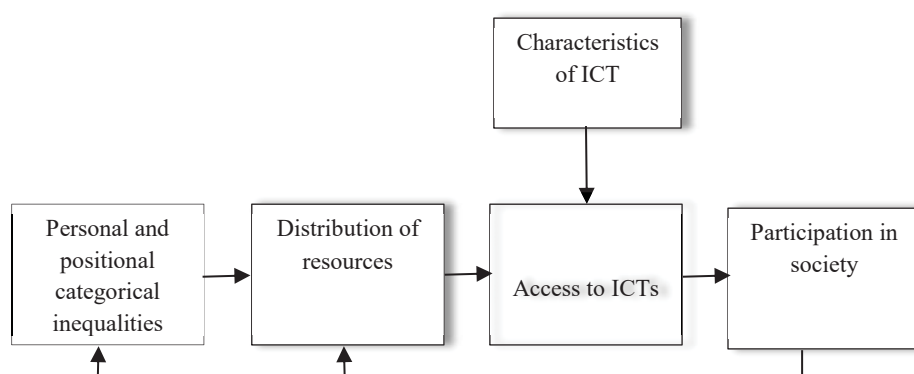


Figure 1: A causal model of resources and appropriation theory.
 Source: Van Dijk, 2005, p. 15.

It can be noted from the description and figure 1 that the RAT considers the relationships between various factors in the process of appropriating technology. In the current study however, focus is put on “access” to ICTs (digital technologies) in order to develop an understanding on teacher educator’s digital competence in the teaching of art and design in Uganda. Access to digital resources is vital in the process of appropriating technology and the use of such digital resources provides possibilities for one interested in understanding a users’ digital competence which is the aim in this study. Van Dijk (2005:21) argues that, access to digital technologies is divided in four kinds (figure 2) namely; “motivational access (motivation to use digital tools), material or physical access (possession of computers and internet connections or permission to

use them), skills access (possession of digital tools, operational, informational and strategic) and usage access (number and diversity of applications, usage time)". Van Dijk (2008) notes that quite often the term "access" is equated to physical access which he describes as narrow and it does not sufficiently explain the diversity of phenomena that are related to inequality concerning the use of digital technology. For this reason, this study adopts van Dijk's (2005) conceptual definition of the term "access" in order to have a broader understanding and be able to address the research questions.

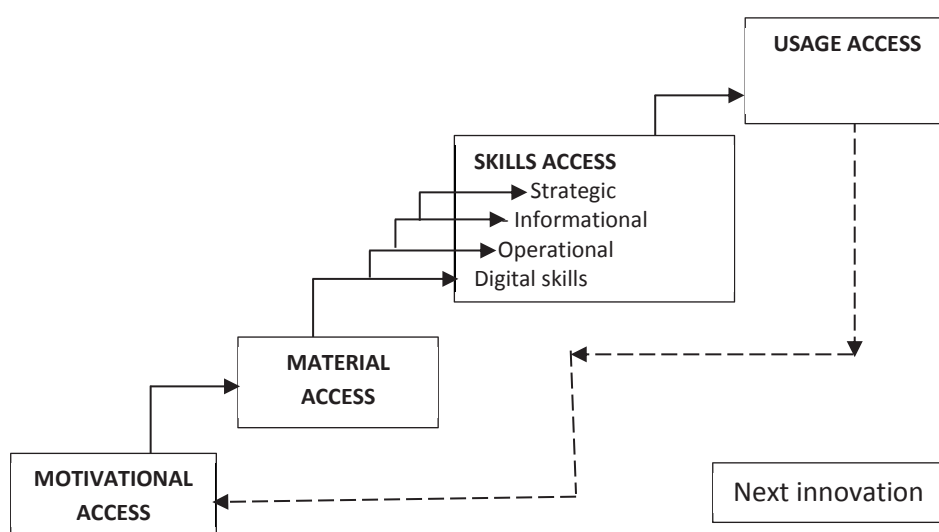


Figure 2: Model of successive kinds of access to digital technologies

Source: van Dijk, 2005, p. 22

While in their study, van Deursen & van Dijk (2015) indicate that the digital divide policies focus on skills and usage access, Fang, et al. (2019) posit that, a better understanding of the social determinants of inequities (e.g., age, gender, income, and ability) that exist across users in accessing and using technologies is crucial for developing policy and practice. Thus, motivation and material access remain relevant since they are necessary through the entire process of appropriation of digital technology (van Dijk, 2005). Van Dijk (2005) further argues that, to appropriate a new technology one should first be motivated to use it and that, when sufficient motivation is developed a user should be able to acquire physical access to a computer, the Internet or another digital medium and later develop digital competences to apply them. Van Dijk emphasizes that having material/physical access without developing the competences to use it doesn't automatically lead to appropriation of technology. At this point, he suggested that

practice is more important than formal education in developing digital skills thus supports the approach of learning on the job. In addition, he proposes that usage can be measured by the observation of the frequency of usage and the number and diversity of applications. Thus, teacher educators like any other users need to have access (motivation, material, skills and usage) to digital technologies in order for them to effectively appropriate technology in their teaching practices. The four successive kinds of access as illustrated in figure 2 are further elaborated in the ensuing sub- sections.

3.1.1 Motivational access

The motivation of potential users to adopt, acquire, learn and use new digital technologies (e.g. computers and the internet) is the first phase of access in the process of developing technology users' (such as, educators) digital competence in society. When the technology has largely diffused in society the motivation to obtain digital technologies is fast. Van Dijk (2005: 28) notes that the presence or absence (the rise or fall) of motivation varies relatively from simple lack of interest, perceived usefulness, time, money and skills to a difficult-to-grasp mixture of technophobia, computer anxiety and lack of self-confidence. Thus, its presence might influence the decisions to purchase a digital tool(s) like computer and the internet, to learn the requisite skills or use interesting applications and vice versa. According to Stewart (2007) social norms and social support by people in one's social network or society affect motivation and intention to accept new digital media. For instance, van Dijk (2008) observes in Europe and in some other parts of the developing world that, the motivational divide has become smaller, it is increasingly taken for granted that people have a computer and Internet connection and the phenomena of technophobia and anxiety have been reduced. Thus, technology users (e.g. educators or students) may assist others to learn the needed skills and use particular applications in educational situations. Also, in countries with a high diffusion of technologies even elderly people and people with low education are motivated to gain access, often afraid of being excluded from society or of not being able to communicate with grandchildren or family and friends (van Dijk, 2017).

Finally, the notion of motivational access is primarily shaped by attitudes toward technology and therefore attitudes should be considered object specific, while motivations are more goal specific (van Deursen & van Dijk, 2015). In this case teacher educators need to have

positive attitude towards new technology for them to be motivated to adopt such technologies in their day-to-day pedagogical practices.

3.1.2 Material access

Van Dijk (2005:48) briefly describes material or physical access as entry to or possession of hardware, operational software and services of computers and other digital technologies either at work, school, and public place such as libraries or internet cafes, home or in transit on a laptop or mobile phone. Physical access to digital technology is mostly influenced by one's income among other factors like one's level of education, age and gender worldwide. In poor developing countries for instance, it is a luxury to individually own expensive digital equipment. In such countries, physical access is mainly realized in public places or at work or school. However, it is important to note that not only material resources (e.g. income) influences physical access but also mental resources (technical knowledge and skill) and social resources (social networking) are decisive in obtaining access to digital technologies (Van Dijk, 2005: 52). He maintains that, societies with lower social and economic development and a lower rate of diffusion of information and communication technology are more likely to have limited physical access to digital technologies (van Dijk, 2005).

Consequently, teachers need material resources (income, digital hardware and software and right to use them), mental resources (skills and sufficient knowledge of digital technology) and social resources (social networks, communication and support) to obtain physical access in the process of adopting digital technologies in their teaching practices.

3.1.3 Skills access

Van Dijk (2005:73) defines *digital skills* as a collection of skills needed to operate computers and their networks or other digital technologies, to search and select information and use such information for one's own purposes. First, van Dijk (2005) divided the concept 'digital skills' into three types of skills needed namely: operational skills (skills used to operate computers and their network hardware and software), information skills (skills needed to search, select, process and evaluate information in computer and network sources), and the strategic skills (capacities to use digital sources to achieve specific and general goals of improving one's position in society). Later the concept of digital skills was refined to include six types digital skills applicable to the internet (internet skills) categorized into medium-related and content-related skills (Van Deursen

& Van Dijk, 2010) as indicated and defined in figure 3. Thus, medium-related skills include; operational and formal skills whereas content-related skills include; information skills, communication skills, strategic skills and content-creation skills.

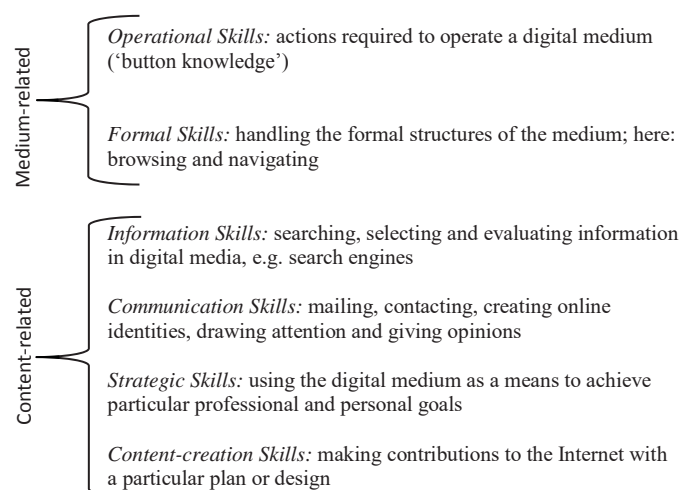


Figure 3: Six types of digital skills applied to internet skills

Van Laar, van Deursen, van Dijk, & de Haan (2017) observe in their systematic literature review article that digital skills relate to 21st-century skills in terms of concepts used and the crucial role they play in a digital environment. However, they argue that the combination of the two concepts is not yet sufficiently defined. Instead, van Dijk (2005) recognizes that digital skills can be acquired through courses or other types of formal education, using course material, operational manuals and help functions. He noted that acquiring digital skills most often is a question of learning through practice, by trial and error and with the help of others who are close. Such skills are incorporated into the daily practices of education, work and leisure time.

Perhaps a reason why he argues that, it is extremely difficult to determine the actual level of digital skills possessed by people because most digital skills are not the result of computer courses, but of learning through practice in particular social user environments (van Dijk, 2005). Van Dijk (2005:90-92) adds that even in formal educational settings, learners acquire digital skills informally through observation, imitation, experimentation, modelling, question and answer and feedback in addition to do-it-yourself approach and learning from close people (communities of practice). He concludes however that the importance of gaining digital skills

through practice doesn't rule out the absolute necessity of formal education for particular purposes. For instance, operational skills will remain incomplete when they are only learned by trial and error. Further, in their study, van Deursen & van Dijk (2009) report that lower levels of education and aging seem to contribute to the amount of experienced operational and formal skill related problems whereas younger participants experienced far less operational and formal skill related problems. However, there was no difference regarding information and strategic skill related problems.

3.1.4 Usage access

Evidently, the purpose of the total process of appropriation of digital technology is usage (van Dijk J. , 2008). From the above discussion, it can be noted that, having sufficient motivation, material or physical access and skills to apply digital technology are necessary but not sufficient conditions of actual use. According to Van Dijk (2005:95), a user might be motivated to use digital technologies, have physical access to them and command the digital skills necessary to use them but nevertheless have no need, occasion, obligation, time or effort to actually use them. Usage is determined by properties of digital technology related to hardware, software and content and can either support or impede access. As a dependent factor, Van Dijk (2013) argues that usage can be measured in at least four ways namely: usage time and frequency; number and diversity of usage applications; broadband or narrowband use and more or less active or creative use.

Van Dijk observes that one's attitude, skills and materials used might affect usage in their own way. They all might interact with each other to shape digital inequalities. On the other hand, Van Dijk (2005) used the term deepening divide to emphasize that the problem of digital inequality does not end after physical access has been attained but actually starts when the use of digital media is incorporated into daily life.

In summary, the concept *access* is used in both narrower and broader senses in the process of appropriation of technology. The most common narrow meaning is physical access. However, physical access is not a single decision to adopt and purchase a particular technology but a continuing process of getting access to new versions of hardware and software, peripheral equipment, and subscriptions. Obtaining physical access makes no sense when people are not able to use the technology. So, digital skills and competencies are also needed for access. When

people have learned to operate and understand a technology, the purpose of access and the final goal of appropriating the technology (actual usage) will be looked for (Van Dijk J. , 2017)

However, whereas the RAT provides possibilities for one interested in studying the digital divide and understanding users' digital competence through addressing different kinds of access to digital resources in the process of appropriating technology, it is limited in itself and has often been criticized (Mariën, et al. 2016; Brandtzaeg, Heim and Karahasanovic, 2011). For instance, Mariën, et al (2016) have questioned whether the consecutive nature of the model continues to be valid today, given the ongoing and relentless digitization of society and to whether individuals are still first to be motivated to use digital technologies. Indeed, it is important to mention here that the present study does not apply the concept "access" in a successive nature as posited by van Dijk (Figure 2) but rather the study uses van Dijk's different kinds of access (motivation, material, skills, usage) in a more flexible or random approach to guide the research process and illuminate their findings. For instance, I argue that, it is not mandatory that one should first be motivated to use digital technologies such as a computer in order to be able to acquire physical access to a computer, and later develop digital competences to use it. A user could also first have the physical access to the computer and be in position to develop the digital skills and finally be able to use the computer. Besides, another gap more specific to the present study is that, RAT does not focus on teacher educators and the nature of knowledge educators require to integrate technology into teaching and how such knowledge can be developed to which the TPACK framework points to. Subsequently, for this reason the present study adopted the TPACK framework to supplement RAT in addressing this knowledge gap so as to effectively connect, clarify and convey the research findings as further elaborated in the ensuing section.

3.2 The TPACK framework

The TPACK framework introduces the relationships and the complexities between the three basic components of teacher knowledge (content, pedagogy, and technology) (Mishra & Koehler, 2006; Koehler & Mishra, 2008) suitable for conceptualizing teacher knowledge needed for appropriately teaching with technology. At the intersection of these three knowledge types (see Figure 4) the authors suggest an intuitive understanding of teaching content with appropriate pedagogical methods and technologies. Accordingly, Mishra and Koehler (2006) posit that

TPACK framework helps teachers to consider how their knowledge domains intersect in order to effectively teach and engage students with technology. The approach looks at a combination of what teachers know, how they teach and how technology is used in order to better impact students learning. Conversely, seven components of knowledge (see Figure 4) are included in the TPACK framework and are described below:-

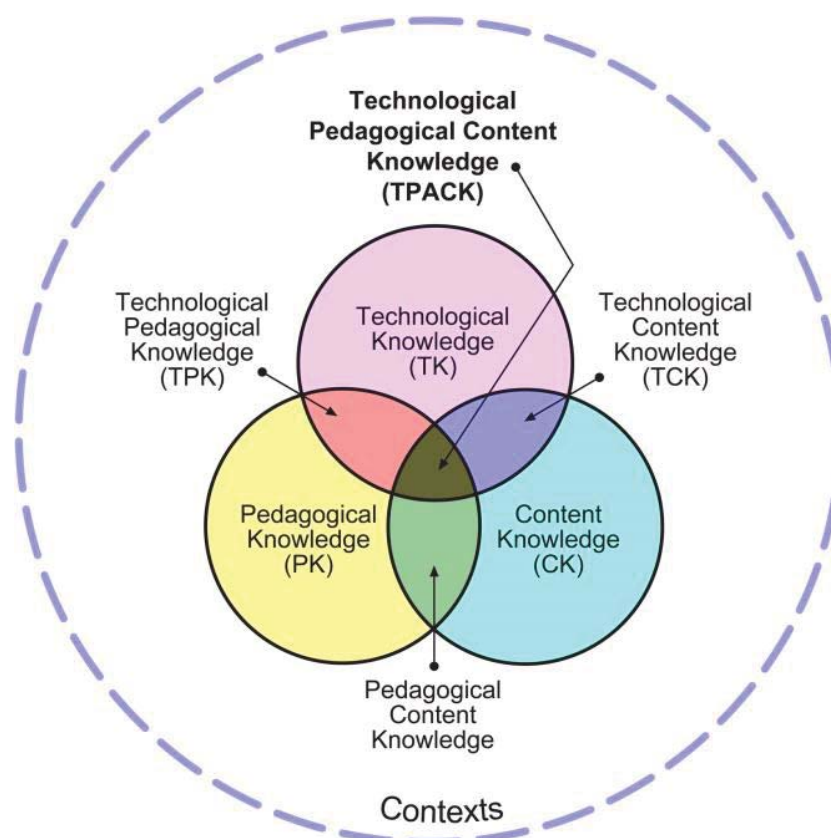


Figure 4: TPACK Framework (Mishra and Koehler, 2006)

Content Knowledge (CK) is the "knowledge about actual subject matter that is to be learned or taught" (Mishra & Koehler, 2006, p. 1026) or simply a teachers' understanding and expertise on the subject they teach e.g. arts and design, science, social studies, math, language or other curricula areas). CK is also made up of the other facts, concepts and theories of any given discipline as well as established practices and approaches towards developing such knowledge (Shulman, 1986). Mishra and Koehler (2006) suggest that educators must know about the content they are going to teach and how the nature of knowledge is different for various content areas. Therefore, it is important educators are effectively prepared by their teacher education programmes to develop mastery over the content.

Pedagogical Knowledge (PK) is the how, a teachers' expert knowledge of the art and science of teaching from learning theories to instructional design. PK encompasses knowledge of educational purposes, values, aims and knowledge about techniques or methods used in the classroom as well as strategies for evaluating student understanding and help students apply new learning to their existing knowledge. As a generic form of knowledge, PK applies to student learning, classroom management, assessment, lesson plan development, and student evaluation. Hence, educators should be trained to possess this form of knowledge for them to understand how students construct knowledge and acquire skills in different ways, and how they develop habits of the mind and dispositions toward learning.

Technology knowledge (TK): refers to the knowledge about various technologies, ranging from low-technologies such as pencil, book, paper, chalk and blackboard to more advanced digital technologies such as the Internet, digital video, interactive whiteboards, and software programs. Koehler et al. (2011) add that, TK is knowing about print and digital technologies including how to operate, install, remove, create, and archive information. TK further represents one's knowledge about the tools including how to select, use and integrate technology into the curriculum but it's not just about the devices, it's also the quality of content students assess through apps, websites and games for learning. It is however important to note that, TK is dynamic (Apau, 2017). This implies that teachers may have to acquaint themselves with special sets of TK that would help them adjust to new technologies that would emerge with time. In this regard, it is vital for teacher training programmes such as art and design to be designed to accommodate the dynamic nature of technology.

Pedagogical Content Knowledge (PCK) on the other hand is the intersection of the pedagogical and content areas. The knowledge a teacher has of how to effectively engage students in learning concepts and skills. This knowledge includes approaches for addressing different learning styles and scaffolding content for deeper understanding. Educational psychologist Shulman (1987) shows this intersection as 'teaching at its best' and argues that the acquisition of only CK is as useless as content-free skills. This implies that teachers' possession of content knowledge without the skills that will make it coherent to students renders it invaluable in the teaching process. Thus, there is an enormous task on teachers to find the appropriate means of ensuring that they have knowledge of the content and knowledge of the pedagogy which forms their PCK. Shulman (1986) suggested that teachers must also know how

students generally understand their subjects, and areas that they consistently misunderstand. This can then help teachers anticipate these misunderstandings and know how to deal with them when they arise. Trainin and Friedrich (2014) add that teachers who possess PCK know the most useful forms of representation for the concepts they teach; the most powerful analogies to help students connect with classroom content. By integrating technology into PCK, a teacher has new insights into and opportunities for students' learning and he/she is able to effectively connect the three components to create in-depth learning for students.

Technological Content Knowledge (TCK) on the other hand refers to how technology is used in the subject area to create new representations for specific content for deep and everlasting learning. For instance, to further their understanding of the topic, scientists can use sophisticated tools to collect evidence, make observations and document findings. Interactive software can then allow them to see their data represented in various ways. Similarly, in art and design education, technological-content knowledge could relate to knowing how to use Adobe Illustrator software to demonstrate illumination effects. Thus, application of such technologies can help deepen individual student's inquiry within a given discipline. Mishra and Koehler (2006) note that, by using a specific technology, teachers can change the way learners practice and understand concepts in a specific content area. Therefore, educators need to know not just the subject matter (content area) they teach but also the manner in which the subject matter can be enhanced by the application of technology, the fact that technology affords the types of content to be taught (Apau, 2017)

Further, Technological Pedagogical Knowledge (TPK) is one's understanding of how to choose and manage technology for students. It includes knowledge of how various technologies can be used in teaching (Muhtadi, Wahyudin, Kartasmita, & Prahmana, 2017), and to understand that using technology may change the way teachers teach. As such, teachers with TPK are able to make their subject matter knowledge understandable and accessible to students through the use of technologies. This is because such teachers understand that a range of tools exist for a particular teaching task and possess particular abilities to choose a teaching tool based on its fitness, strategies for using the teaching tools, and knowledge of pedagogical strategies and the ability to apply those strategies for use of technologies (Apau, 2017). Therefore, it is vital for teacher education programmes to expose prospective teacher educators to ways of representing and formulating subject matter with repertoire of emerging digital technologies.

In view of the above descriptions, it is important to note that at the intersection of the three knowledge domains (figure 4) is the core of TPACK. TPACK refers to the knowledge required by educators for integrating technology into their teaching in any content area. Therefore, the teacher needs technological knowledge, as well as knowledge about content and pedagogy (Mishra & Koehler, 2006). Teachers also need an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that student teachers face. In addition, teachers need to know the students' prior knowledge and theories of epistemology and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones. Consequently, the compound knowledge of issues raised from the intersections between technology, pedagogy, and content in the TPACK framework is instrumental tool to explore teachers' awareness regarding the relationship between technology, pedagogy and content in the teaching and learning process in different educational settings (Soomro, et al., 2018).

Conversely, although the TPACK framework has been credited by different scholars as presented in this section for its suitability in conceptualizing teacher knowledge needed for appropriately teaching with technology, Mishra (2019) adds that, the lack of teacher's knowledge of the context (figure 4) limits the effectiveness and success of any TPACK development, or a teacher's attempts at technology integration. According to Mishra (2019), Contextual Knowledge would be everything from a teacher's awareness of available technologies, to the teacher's knowledge of the school, district, state, or national policies they operate within. Moreover, some studies (Voogt & McKenney, 2017; Apau, 2017) report very limited integrated TPACK among teacher educators, and that there are very few courses or learning opportunities through which pre-service and in-service teachers could develop integrated TPACK knowledge. As a result, Voogt and McKenny (2017) suggest the need for teacher education institutions to invest in developing the TPACK of teacher educators to ultimately help prepare new teachers for using technology in their subject fields. Besides, Koehler and Mishra (2009) suggest an intuitive understanding of teaching content with appropriate pedagogical methods and technologies. Harvey & Ronald (2016) add that, through TPACK, educators can develop digital competence within an advanced technology integration programme. The TPACK can further help educators

to consider which areas they feel confident about and the areas where they need to improve upon to become thoughtful practitioners (Mishra and Koehler 2006). Teachers who have an intuitive understanding of the complex interplay between the three basic components of knowledge (CK, PK, TK) in their subject areas can innovatively enhance teaching and support student's learning more deeply and effectively with technology (Mishra and Koehler, 2006).

To sum up, this chapter has broadly presented and discussed the theoretical perspectives from van Dijk's (2005) RAT and Mishra and Koehler's (2006) TPACK framework, also partly highlighting their strengths, shortcomings and relevance to the present study. While van Dijk's RAT focuses on a more general use of digital technologies addressed through four kinds of access (motivation, material, skills and usage), the TPACK framework specifically presents a set of knowledge domains (highlighted through the complex interplay of technology, pedagogy and content) necessary for all teachers to effectively integrate digital technologies in the pedagogical process. Even though, the two theoretical models seem to have divergent focus, what binds them is their call for increased technology integration in education or other everyday activities. Van Dijk's RAT calls for technology integration by addressing the digital divide through the concept 'access' whereas Mishra and Koehler's TPACK framework calls for specific knowledge necessary for educators in order to effectively integrate technology in pedagogical process. Therefore, combining the two theoretical lenses in the present study was envisaged to be more appropriate and relevant strategy in guiding the research process and illuminate the research findings. As such, the present study relied on van Dijk's theoretical concepts of access (i.e. motivation, material, skills and usage) to digital technologies as well as perspectives from the TPACK framework as tools in the analysis of data and discussion of findings in the articles (*see Appendices 1, 2 and 3*) with respect to the research questions. Specifically, the two theoretical models helped in understanding; how Ugandan TEs use digital technologies in teaching A&D (*Article I*), how TEs develop digital competences (*Article II*) and the challenges TEs encounter when teaching A&D with digital technologies (*Article III*).

4 Methodology

This chapter provides a description and the rationale for the choice of the research design that was employed, the samples, data collection methods and procedure followed in conducting the study. The chapter also discusses how the data collected was analyzed, in particular, the tools employed for analysis. Further, validity and reliability of the instruments and study findings are discussed in this chapter. Finally, the chapter presents the ethical considerations that were deemed relevant for this study.

4.1 Research Design

Yin (2014) highlights that every type of an empirical research study has an implicit, if not explicit, research design which is a logical sequence that connects the empirical data to a study's initial research questions and conclusions, including the collection and analysis of relevant data. Similarly, Philliber, Schwab, & Samsloss (1980) present a research design as a “blueprint” for one's research that addresses: “what questions to the study, what data are relevant, what data to collect and how to analyze the results” (cited in Yin, 2014, p.29). In relation to the current study, a case study design (Yin, 2014) was adopted based on qualitative research methods to gain insights into the following research questions:

RQ1: In what ways are teacher educators using digital technology when teaching art and design in Uganda?

RQ2: How do art and design teacher educators develop their digital competence in Teacher Training Institutions in Uganda?

RQ3: What challenges do teacher educators encounter when teaching art and design with digital technology in Uganda?

A case study is an empirical inquiry that investigates a contemporary phenomenon (the “case”) in depth and within its real-world context especially when the boundaries between the phenomenon and context may not be clearly evident (Yin, 2014, p.16). As such, case study can be used in many situations to contribute to our knowledge of an individual, a group, an organization, an event, a problem, or an anomaly and related phenomena (Yin, 2014). Case studies thus allow for the researcher to develop an in-depth description of a case (such as an

individual person) or multiple cases (for example, several such individual persons) under investigation (Creswell, 2007; Yin, 2014). Further, case study design can embrace different epistemological orientations. For example, the case study research can assume a realist perspective, which assumes the existence of a single reality that is independent of any observer, and a relativist perspective that acknowledges multiple realities having multiple meanings, with findings that are observer dependent (Yin, 2014) as in the current study. As such, it was necessary to select a method that would help in an attempt to make sense of key research questions in terms of the meaning participants bring to them. Besides, an advantage of using a case study design is its dynamic nature that allows the variety of data collection methods and types as well as the possibility to modify the design continuously and to choose procedures as one learns more about the phenomenon (Denzin & Lincoln, 2005). Indeed, the choice of the research design was also helpful in making modifications such as revising the research questions where it was necessary in order to gain an in-depth understanding on the contemporary phenomenon under investigation.

Conversely, qualitative research methods were preferred in the current study because they are reported to focus on what happens in everyday life (contemporary phenomenon) and entails an emphasis on the qualities of entities, processes and meanings that are not experimentally measured in terms of quantity, amount, intensity or frequency (Silverman, 2013) so as to build knowledge. Such qualities were essential in the process of understanding how teacher educators use digital technologies, how teacher educators developed their digital competences in a developing country like Uganda and the challenges teacher educators encounter in the process of teaching with digital technologies.

4.2 Study Sites and sample selection

Creswell (2007) posits that, in order to select a case, the researcher has to develop a rationale that includes a contextual understanding of the research setting. As such, the current study was conducted at two teacher training institutions (TTIs) located in the central region of Uganda. One of the institutions - Kabwohe (pseudonym) is located in Kampala district; Nakawa division just 8 km east of the capital city, Kampala and the other - Sheema (pseudonym) is located in Wakiso district, Kira Municipal Council approximately 13km east of the capital city Kampala. The rationale for the choice of central region in Uganda was the fact that it inhabits different groups

of people from all over the country which made it easier to get diverse samples representative of the selected population in Uganda. On the other hand, the institutions were selected because of the existing digital infrastructure and efforts to integrate digital technology in their teacher training programmes. Over the years, the selected institutions have participated in a number of pilot projects initiated by the Ugandan government and/or its development partners to introduce ICT in the teaching-learning activities in order to promote digital literacy amongst students and staff (Farrell, 2007; Luwangula, 2011; Uganda, 2014c). Through their participation in these projects, the institutions have received, from government and its development partners, basic digital infrastructure to support the integration of digital technology for pedagogical purposes. Therefore, it was pertinent to have the study conducted at these institutions in order to investigate teacher educators thoughts and practices relating to the study's research questions.

4.3 Study population, sample size and strategy

The quality of a piece of research stands or falls not only by the appropriateness of methodology and instrumentation but also by the suitability of the population on which the research will focus and sampling strategy that has been adopted (Cohen, Manion, & Marrison, 2007). Consequently, researchers often need to gain information from the whole study population to be able to obtain data from a smaller group or subset of the total population (sample) in such a way that the knowledge gained is representative of the total population under study. As regards the present study, the study population, the sample size and the sampling strategy and justification for their choice are described in the ensuing subsections.

4.3.1 Study population

The study population comprised of A&D teacher educators (TEs), teacher trainees (TTs) and administrators (ADs) at two teacher training institutions located in the central districts of Uganda earlier described under 4.2. In the Ugandan context, A&D TEs may include lecturers, tutors, instructors, technicians and studio or laboratory attendants at different levels of A&D teacher education. TTs also represented as student teachers in some sections of this thesis are learners studying to become teachers and directly observe TEs' classroom instruction and digital

practices. In this study, TTs in their final year of study and had been on ‘school practice’¹ from both TTIs comprised of the study’s population. On the other hand, ADs are persons responsible for overseeing the daily teaching or managerial operations in the TTIs and thereby have knowledge and experience on the prevailing teaching and learning conditions in Ugandan TTIs. Although this study focused on TEs, it was necessary to include TTs and ADs as part of the total population because they are key stakeholders in the teaching process in TTIs. Besides, the categories of respondents in target population had insights and awareness of the problem under investigation thus provided the required information for the study. The research field (Art and Design education) on the other hand was chosen as part of the study area based on the researcher’s area of competence. Having been formally trained as an art and design educator with specialty in computer graphic design to masters’ level, it was only convenient to choose an area where I possessed expertise. In the context of this study, art and design education, is concerned with the process of preparing students for certification to teach art or design education at primary, secondary or tertiary level in Uganda. This teacher training programme combines teaching and learning how to create and produce art and design works in the visual and performing arts.

4.3.2 Sample size and sampling strategy

Boddy (2016) argues that, the determination of sample size in qualitative research is contextual and partially dependent upon the scientific paradigm under which investigation is taking place. For example, qualitative research which is oriented towards positivism will require larger samples than in-depth qualitative research does, so that a representative picture of the whole population under review can be gained. Similarly, Isaac & Michael (1995) concur and recommend that research involving small sample sizes is justifiable when the research involves in-depth case study from which rich amount of qualitative data are forthcoming from each individual respondent. In line with these recommendations and based on the research design employed in this study and nature of the research questions, it was prudent to purposively select a sample that would not only yield insights but also provide an in-depth understanding of the research questions rather than empirical generalisations (Patton, 2002). Therefore, the sample

¹ School practice is a critical component of effective preservice teacher education in Uganda. It provides an essential practice space to teacher trainees for generating concrete problems and issues, and applying new knowledge and skills, but also enabling the development of an integral link between university theory and school-based practice.

size that was purposively selected as representative of the study population included; ten teacher educators (TEs), ten teacher trainees (TTs) and four administrators (ADs) as illustrated in table 3.

Table 3: Composition of the participants, sampling strategy and methods

<i>Category of participants</i>	<i>Population</i>	<i>Sample size</i>	<i>Sampling strategy</i>	<i>Methods</i>
Administrators (ADs)	6	4	Purposive	- Interviews
Teachers educators (TEs)	20	10	Purposive	- Interviews - Observation
Teacher trainees (TTs)	20	10	Purposive	- Interviews
Total	46	24		

Source: Primary data

Purposive sampling helped in selecting cases that were likely to be information rich (Gall, Borg, & Gall, 2003; Patton M. , 1990) in the current study on the basis of the participant's experience or engagement in teaching A&D subjects with digital technologies. For instance, at both institutions, the administrators in charge of academic management were requested in writing² to identify and recommend the target population (i.e. teacher educators and teacher trainees) to participate in the present study. Thereafter, all the participants that expressed interest to participate in the study were directly contacted and on the basis of their experience or engagement in teaching art and design subjects with digital technologies were, first presented with a consent letter to participate in the study. Only those that would accept through appending their signature on the consent letter would be taken as actual samples for the current study.

It is also important to report here that, even though the current study has no focus on gender related issues and comparisons, efforts were taken to consider the participants' gender distribution. On availability, an equal gender (male/female) distribution of participants in both institutions was taken into account. Tables: 4, 5 and 6 respectively present the characteristics participants (i.e. TEs, TTs and ADs) that comprise the sample size in relation to gender distribution, participants' teaching or work experience and their areas of specialization in the field of A&D teacher education.

² See Call for research participants in Appendix 16

Table 4: Characteristics of TEs

Particulars	Teacher Educators (TEs)									
	TE#1	TE#2	TE#3	TE#4	TE#5	TE#6	TE#7	TE#8	TE#9	TE#10
Participant Code:										
Gender:	M	F	F	M	M	F	M	M	M	F
Teaching Experience (Years):	12	10	30	15	36	17	20	5	19	20
Period Teaching with Digital Technology (Years)	8	10	2	10	23	7	5	5	7	11
Area of specialization :	Multi-media	IPS /Art & Design	IPS /Art & Design	Graphic Design	Art History / Graphic Design	Painting/ Interior Design	Painting	Interior Design	Graphic Design	Graphic Design
Institution	Kabwohe	Sheema	Sheema	Kabwohe	Kabwohe	Kabwohe	Kabwohe	Kabwohe	Kabwohe	Kabwohe

Table 5: Characteristics of TTs

Particulars	Teacher Trainees (TTs)									
	TT#1	TT#2	TT#3	TT#4	TT#5	TT#6	TT#7	TT#8	TT#9	TT#10
Participant Code:										
Gender:	M	F	F	M	F	M	F	F	F	M
Teaching Experience (Years):	4	4	1	4	8wks	8 wks	8 wks	4 weeks	8 wks	8 weeks
Period Teaching with Digital Technology (Years)	3	1	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A
Area of specialization:	Graphic Design / Drawing	Fabric decoration	Fabric decoration	Graphic Design	Music/ IPS-Art & Design	Music/ IPS-Art & Design	Music/ IPS-Art & Design	Music/ IPS-Art & Design	Music/ IPS-Art & Design	Music/ IPS-Art & Design
Institution	Kabwohe	Kabwohe	Kabwohe	Kabwohe	Sheema	Sheema	Sheema	Sheema	Sheema	Sheema

Table 6: Characteristics of ADs

Particulars	Administrators (ADs)			
	AD#1	AD#2	AD#3	AD#4
Participant Code:				
Gender:	M	F	M	M
Position held at institution:	Academic coordinator	Administrator	Academic Coordinator	Deputy Principal
Period serving in position: (Years)	4	2	4	3
Institution	Kabwohe	Kabwohe	Sheema	Sheema

4.4 Data collection methods and procedure

The main aim of present study was to contribute with insights into teacher educators' digital competence in teaching Art and Design subjects in teacher training institutions (TTIs) in Uganda.

It was important therefore to apply methods that would aim at studying people's behaviour and interaction with digital tools. In this case, Kvale (1996) suggests that; observation and personal interviews may give more valid information. Myers (1997), adds that the use of qualitative research methods such as interviews and observation help researchers understand people and the social-cultural contexts within which they live. Thus, in view of this study, in-depth semi-structured face-to-face interviews and non-participant observations were employed to collect data from the participants.

Besides, the two methods were employed in order to complement each other in triangulating the data to increase validity and reliability of the findings (Yin, 2014; Cohen, Manion, & Morrison, 2007; Patton, 2002). Yin (2014) observes that, various sources of evidence are highly complementary, and a good case study will therefore want to rely on as multiple sources of evidence as possible. Thus, the methods and procedure employed is further elaborated in the ensuing subsections.

4.4.1 Interviews

An interview is a qualitative research method because it allows the researcher to gather in-depth face-to-face data (Patton, 2002). Yin (2014) observes that, interviews are essential source of case study evidence as most case studies are concerned with human affairs or actions. Yin argues that well-informed interviewees can provide important insights into such affairs or actions based on their personal views expressed through opinions, attitudes and meanings.

Although there are various types of interviews, in-depth *semi-structured interviews* were adopted in this study to gather information from the participants. A semi-structured interview is a form of interview based on a checklist or guiding questions to help guide the interviewer through the interview process (Cohen, Manion, & Morrison, 2000; Patton, 2002). The general aim for adopting semi-structured interviews was to encourage the participants to speak personally, freely and in detail about their lives, while at the same time giving their thoughts, feelings, and opinions to the research questions.

Although they maintain some structure, semi-structured interviews are flexible, open-ended (Patton, 2002; Silverman, 2011) and provide the interviewer with the ability to probe the participant for details. Silverman (2011) argues that, the open nature of semi-structured interviews also enable participants to demonstrate their unique way of looking at the world.

Therefore, with the help of semi-structured interview guides³, interviews were conducted with each individual participant at separate intervals of the participants' convenience and lasting for an average of one hour (Yin, 2014). This period of time was sufficient to explore the deeper meaning of participants' views in relation to the research questions before a saturation point was reached. Saturation implies that sufficient and redundant information for all aspects of the phenomenon under research has been gathered (Glenna, 2008; Morse, 1995), and thus, no further themes or concepts can emerge.

The interview guides and observation checklist had been designed and pre-tested in advance with a group of experts in the area of this research including; academicians (e.g. supervisors), practitioners and consultants to ensure consistence and focused on gathering insights into participants' views and their first hand personal experiences in relation to the research questions (Meredith, Walter, & Joyce, 2007). The experts were able to advise by giving their feedback on the quality of the data collection tools. Indeed, the nature of interviews in this study gave participants the freedom to express their views, experiences, beliefs and motivations (Gill, et al., 2008), which provided reliable and comparable data (Barriball & White, 1994; Cohen & Crabtree, 2006). All the interviews were audio recorded and later transcribed into text with the other data obtained through observations (such as field notes and comments made during the observations).

4.4.2 Observations

According to Cohen, Manion, & Marrison (2007), there are two principal types of observation—participant observation and non-participant observation. In the former, observers engage in the very activities they set out to observe and often become one of the group. Non-participant observers, on the other hand, collect data by observing behavior without actively interacting with the participants or the group activities they are investigating and they avoid group membership. For instance, a non-participant observer would sit at the back of a classroom coding up every actions or verbal exchanges between an educator and learners by means of a structured set of observational guide.

In the current study, *non-participant observation* was used to level out researcher biases in the other method (in-depth interviews) and to reveal differences between what participants say

³ See Interview guides in Appendices 2 (*Teacher Educators and Trainees*) and 3(*Administrators*)

and what they actually do (Cohen et al., 2007). Besides, observation-based methods enable researchers to assess nonverbal expressions of feeling, to see how participants interact among themselves and with other objects, and to check how much time is spent on various activities (Kawulich, 2005). Thus, in the present study TEs were observed engaged in classroom practice with their students at each institution and field notes were always taken from personal observations. The field notes from the observations later became one of the data sources that provided important information used in the analytical process and to triangulate with data from interview transcripts.

The non-participant observations were aided by an observation guide⁴ inspired by the TPACK observation checklist (Trainin & Friedrich, 2014), a tool to assess teacher application of their technology, pedagogy and content knowledge - TPACK (Mishra & Koehler, 2006) in classroom practice. Thus, in this study, the observation checklist focused on a number of items: firstly, the composition of the classroom (for example, students, classroom environment); secondly, the TPACK question (for example, how TEs observed the relationship between different components i.e. TK, CK, PK, TCK, TPK, PCK and TPCK); thirdly, teaching learning activities (for example, pedagogical approaches and students' participation); and fourthly, the evidence of TPACK in the lesson plan.

It is important to note in this study that, even though efforts were taken not to interfere with the participants and using unobtrusive means to collect data during the non-participant classroom observations, the participants (TEs and TTs) were aware of my presence. However, I tried to adhere to the researcher's role and status at the site (Fink, 2000; Miles & Huberman, 1994) so as to collect as much unbiased "first-level construct" raw data as possible. The length and depth of the observations were dependent on the length of the lesson that on average varied between forty minutes and an hour for every observation at Sheema and Kabwohe respectively.

4.5 Data analysis

The process of qualitative data analysis involves transcribing, organizing, coding, categorizing the content and identifying the emerging themes or categories (O'Connor & Gibson, 2003; Miles, Huberman, & Saldaña, 2014). This according to Patton (2002) implies, identifying consistent and important patterns and themes in the data as well as issues relating to specific research

⁴ See Observation guide in Appendix 6.

questions. In the present study, the analysis started while in the field (Patton, 2002) and all data gathered from individual participants through interviews and observations were separated and given codes (pseudonyms) to protect the identity of institutions and participants in all the transcriptions. Pseudonyms such as: Kabwohe and Sheema were used to represent the institutions whereas specific codes (such as; TE#1, TE#2..., TT#1, TT#2..., AD#1, AD#2...) were accorded to participants (TEs, TTs and ADs) respectively.

Thereafter, based on the research questions and transcribed text or narrative data from interviews and observation field notes, I performed a first-level analysis where transcribed data was first organized by specific questions in the interview guides in table charts created in Microsoft Word to identify frequently occurring words and phrases in the data (Burnard, Gill, Stewart, Treasure, & Chadwick, 2008). These occurring words and phrases were colour-coded, and similar codes were later clustered to define empirical categories as shown in figure 5.

Figure 5: Colour-coding process (first-level analysis)

Topic/Question	TE#1	TE#2	TE#3	TE#4	TE#5	Categories
What challenges do teacher educators encounter when teaching Art and Design with digital technology?	<p>...power cuts, lack of some of the equipment, software, competence to use some of the available tools appropriately and space.</p> <p>Definitely, it prolongs the presentations, you have to either forego the presentation or need more time to make the presentation to students outside the normal learning hours. Lack of the equipment tools sometimes you will need in order to record certain kind of modeling or working and you fail because you don't have a camera like you have seen you forget (laugh) charging your recorder (p. 8)</p> <p>There are quite many digital tools we do not have and can't have access. But just off hand we have digital drawing tools (what can I call them... parts for drawing you just have to use them), umm... we also need like strong kind of storage and VGA computers for particular processing energies for the works we do. There we also have things like plotters for the outputs, printers which really the university is not providing.</p> <p>We have like the PVC printers, for example, large format printers, 3D printers which is now the way to go in product design. There are there but we can't access them.</p> <p>I think it is due to budget issues, limited human resource: (p. 4)</p> <p>Sometimes we don't have power. Power can go off and it makes teaching difficult, you actually fail to teach if you had prepared digital content. And sometimes lack of the tool you want to use also affects teaching with digital tools and space for the digital tools themselves is</p>	<p>It is not directly integrated into the curriculum but there is an effort from the training we have had being made at institutional level to come up with guidelines on how to equip learners with digital skills. Not even the ministry of education examines ICT even when it is offered as a separate subject. Therefore, it is not integrated, it is up to the creativity of the teacher to use digital technology. It is not directly. They have as an independent course. The examination body (Kwambogo) does not examine it. Some teachers use ICT in the classrooms, but it is not directly. They have a skill. There is no policy or guidelines on the use and integration because the ministry has not yet finalized it. However, ICT integration is an issue that UNESCO keeps raising but there is no emphasis done. So if I teach and do not use the technology, I cannot be penalized. Students just learn for their own sake. (p. 3)</p> <p>I probably should have said it earlier. What I have learnt, if every subject teacher does it in their area, there will be more learning to it because the students will have learnt basics from other subjects. Then, students will have maximum usage time in class rather than wasting time to take students through teaching basic use. We do not look at integration. ICT should be integrated in all subjects but not taught separately as a subject because there would be more learning indirectly. The challenge is that there are few people doing it and they do not teach the skills as we would love. Another challenge is the limited facilities. If I have a class of 70 and the</p>	<p>...we could get a WhatsApp page but it has its shortfalls because not every student has a phone. Some have refused to join. Facebook however much you encourage them much as I have a good number of students online. We have also encouraged them to get e-mail addresses because if you have an email address you can collaborate, do many activities like using the google drive. You can do activities on excel but some refused to get on board. Then also, internet is unreliable. And some have phones but not smart phones. They may see the words but the pictures they may not. They are not allowed to have phones and you cannot be with students at night. We might want to play some games but the computers are less and of low capacity.</p> <p>I am limited to use digital tools because we don't have enough digital resources. Each of our classes gets over 60. In this room there are 15 computers and the other room are 20. Having so many students on one computer limits individual students to access and some students will just be onlookers, done off or distract others. That is a major challenge. We want something to be done but we are limited by the resources (p. 2)</p> <p>...it is up to the tutors being creative. Otherwise, ICT is not integrated in the curriculum. It is nowhere but I think in future they will consider it. It is only in PES where there is a little use of technology but not in other subjects.</p> <p>...for now the curriculum is independent from technology. It is up to a teacher to identify content on the internet and share</p>	<p>The digital tools here are not very easily accessible because the lab is very small, students are always many so it is not very easy. (p. 3)</p> <p>First of all, I am not in position to fully use online platforms because the internet is not easily accessible at the department where I work. In most cases, I use the internet on my phone where I buy limited data bundles for myself. It is very expensive to connect money to this area also due to social media tax. Otherwise, if the university was ready to provide internet and it is easily accessible I think that would be very easy to use. About the hardware tools, we also do not have enough hardware tools at the institution, the university does not have them available there is no way I can access them. They are not provided. (p. 4)</p> <p>...you have to go through the trouble of going to get a projector and borrow it and then look for a white surface because you can't find a white surface if you don't have a special room in the event of using a projector, light is all over and it can't project properly. So, there are all those problems that make it difficult. (p. 4)</p> <p>...lack of knowledge and skills because I know there are specialized software that can really do very great assessments on students and personal growth and attributes but I do not have and know those tools and I do not know how to use them. I think it is not necessary to use digital tools, this is not my generation /or negative attitude on the benefits of using digital tools in teaching and learning sometimes can fail teachers to use digital</p> <p>The methodology of how to teach with technology is not well captured and not really emphasized in the curriculum. It</p>	<p>The internet is somehow limited and accessed through wireless (though not consistent) but maybe it is coming up because it was not there. It can be supplemented by loading data on personal smart phones. (p. 2)</p> <p>Because of financial difficulties, the institution is not able to have even laptops, they are simple, portable, and you can manipulate to take photographs, typing or the recorder. (p. 3)</p> <p>...latest technologies are expensive, short-lived and delicate so they need care and professional handling. Ethically, sometimes, digital tools have been misused in art and design during the search for information and photography where students take photos against certain morals. Digital tools bring in the copy and paste syndrome thus the creative aspects (originality, legitimacy and authenticity) are sometimes compromised. (p. 5)</p> <p>lack of digital tools compromises their usage. Then lack of knowledge or competence to use the digital tools as well as self-imposed laziness/state of mind (for instance, having such a mindset as: "uh!!" I think it is not necessary to use digital tools, this is not my generation /or negative attitude on the benefits of using digital tools in teaching and learning sometimes can fail teachers to use digital</p>	<p>Motivational challenges</p> <ul style="list-style-type: none"> -Lack of time -Negative attitude -Lack of self-esteem/confidence <p>Material/Physical challenges</p> <ul style="list-style-type: none"> -Lack or unreliable power -Inadequate access to digital technologies (hardware & software) -Inadequate competence/digital skills -Unreliable internet <p>Other challenges</p> <ul style="list-style-type: none"> -Lack of ICT-enabled curriculum -Lack of institutional ICT policy -Loss of creativity -Financial difficulties <p>Motivational challenges</p> <ul style="list-style-type: none"> -Lack of time -Negative attitude / beliefs/perceptions -Lack of self-esteem/confidence -Loss of creativity -Inadequate competence/digital skills <p>Material/Physical access to digital infrastructure</p> <ul style="list-style-type: none"> -Lack of ICT-enabled curriculum -Lack of institutional ICT policy -Financial difficulties

A second-level analysis was performed using the relevant theoretical concepts and closely examined with respect to the present research questions to trace relationship in perspective.

These theoretical concepts were derived from van Dijk's (2005) RAT and Mishra and Kohler's (2006) TPACK framework on the basis of their relevance to the prevailing research question. During the second-level analysis, the categories identified in the first-level analysis formed part of the findings under relevant theoretical concepts that were translated into over-arching themes in each of the articles. For instance, to analyse data relating to RQ1 (Article I), the present study based on van Dijk's theoretical concepts of access to digital technologies (including access to the Internet), usage frequency and usage diversity (including internet-based resources) and creative use. In addition, the TPACK framework was employed as a tool in the analysis to understand TEs creative use of digital technologies in teaching A&D. On the other hand, the analysis of data relating to RQ2 (Article II) was informed by van Dijk's scientific perspectives on digital skills development through formal and informal approaches. Furthermore, the analysis of data relating to RQ3 (Article III) employed van Dijk's (2005) theoretical concepts relating to motivation and material access to present and discuss the findings. To sum up, it should be noted that, at all times during the analysis, attempts were made to triangulate data by checking one source against the other (Yin, 2014; Patton 2002).

4.6 Validity and reliability

Patton (2002) states that validity and reliability are two factors which any qualitative researcher should be concerned about while designing a study, analysing results and judging the quality of the study. While the concepts reliability and validity are essential criteria for quality in quantitative paradigms (Golafshani, 2003), Lincoln & Guba (1985) refined the concepts in terms of 'trustworthiness' by introducing the criteria of credibility, transferability, dependability, and confirmability in qualitative research paradigms.

Consequently, to be accepted as trustworthy, qualitative researchers must demonstrate that data analysis has been conducted in a precise, consistent, and exhaustive manner through recording, systematizing, and disclosing the methods of analysis with enough detail to enable the reader to determine whether the process is credible (Nowell, Norris, White, & Moules, 2017). As such, validity and reliability (trustworthiness) of the present qualitative research study's process and its findings was addressed to meet the criteria outlined by Lincoln & Guba (1985) during data collection, data analysis, and report writing process as discussed in the ensuing subsections.

4.6.1 Sampling credibility

Sampling credibility was addressed through sampling strategies and triangulation. Purposive sampling for instance, helped to select methods and information rich participants chosen for their relevance to the research questions. In-depth interviews on the other hand provided rich and reliable information as participants had the freedom to express their views, experiences, beliefs and motivations. Through probing for more details during the interview process, it facilitated the understanding of TEs practices and the observations helped to level out or confirm any researcher biases accrued during in-depth interviews and to reveal differences between what participants say and what they actually do (Cohen et al., 2007).

Lincoln and Guba (1985) suggested that credibility can be addressed through triangulation and triangulation can be used to reduce the effects of any possible research biases and set up audit trails (Nowell, Norris, White, & Moules, 2017) of the decisions and choices made by the researcher regarding theoretical and methodological issues throughout the study. Triangulation involves comparing and crosschecking the consistency of information derived from different data sources, methods, participants and research settings which strengthens the validity and reliability (trustworthiness) of the research findings (Patton, 2002; Bryman, 2008). Thus, in this study, information obtained through different data sources was validated through triangulation to increase the credibility and quality of the findings.

4.6.2 Face credibility

Face credibility often referred to as 'face validity' (Patton, 1990) was addressed in the present study by giving opportunity to participants who had been interviewed to check their transcribed interviews, and observation reports in order to confirm their statements and/or make the necessary adjustments (Cohen, Manion, & Morrison, 2000) to assure accuracy of the findings. This in turn helped to improve the quality and credibility of the study findings (Plano Clark & Creswell, 2008; Miller, 2007; Sekaran, 2003) and provided a deeper understanding and made meaning of the data collected during the discussion.

4.6.3 Researcher credibility

According to Patton (1999), the credibility issue for qualitative inquiry depends on among other related inquiry elements, the credibility of the researcher, which is dependent on training, experience, track record, status, and presentation of self. Patton further asserts that,

“Because the researcher is an instrument in qualitative inquiry, a qualitative report must include information about the researcher. What experience, training, and perspective does the researcher bring to the field? What personal connections does the researcher have to the people, program, or topic studied? What prior knowledge did the researcher bring to the research topic and the study site? (Patton, 1999, p. 1198)”

Although there are no definitive list of questions that must be addressed to establish the researcher credibility, the principle is to report any personal and professional information that may have affected data collection, analysis, and interpretation either negatively or positively in the minds of users of the findings (Patton, 1999).

Emanating from Patton’s assertion, I consider the over ten years’ teaching and research experience as an art and design teacher educator in Uganda in addition to previous training in the area of teacher education (biased in Art and Design) to Masters’ level significant attributes I carried to this study in terms of knowledge to deal with related issues. Besides, being a Ugandan carrying out fieldwork in Uganda as a research fellow from abroad defined my role as both an insider and outsider (Dwyer & Buckle, 2009) in this study. As an insider, it was easier to access all the target sites and met with most of the research participants some of who were former work colleagues. However, in certain instances taking on both roles (an insider and outsider) was a potential threat because participants who had known me as former educator/colleague initially thought that I was sent to evaluate and report on their teaching practices. For instance, some participants who felt their institutions and government were unfair and inconsiderate in improving their work situations expected me to help communicate their complaints to the stakeholders including government and funders of the present research project for an immediate action.

To deal with such situations during fieldwork and to ensure the researchers’ credibility and quality of the findings, first, at all times I confirmed to the participants that the study was for academic purposes, and I had to remain unbiased in all situations in order not to influence the

research findings. Second, I sought the cooperation of the participants by appealing to their goodwill and by explaining both the purpose and expected outcomes of the study to ensure that the research process based on informed consent was credible. Third, some participants asked to receive feedback citing previous researchers who had collected information and never shared the outcome. All the participants will receive a copy of the final dissertation and efforts were taken to inform them that the findings will be published through articles in open access journals and that links to such articles would be available to them.

4.6.4 Transferability

Transferability refers to the generalizability of the research findings (Nowell, Norris, White, & Moules, 2017; Carminati, 2018). Although this concerns only to case-to-case transfer in qualitative studies (Tobin & Begley, 2004), generalization beyond a bounded case is possible in qualitative investigations, since consistency of findings when conditions vary are robust (Firestone, 1993). In qualitative studies, the researcher is responsible for providing thick descriptions, so that those who seek to transfer the findings to their own site can judge transferability (Lincoln & Guba, 1985). Thus, in this study, transferability of the research findings was considered by choosing cases from different institutions and their practices constituted a rich, multilayered data set. This sample can possibly be used for generalization across similar cases in Uganda. In addition, using multiple case studies added more possibilities for generalization of findings across cases. Nevertheless, it is possible to compare the findings obtained from the subsets of the sample in terms of observed similarities and differences.

4.7 Access to the research setting and ethical considerations

Gaining access to the research site and becoming accepted is a slow process (Oyenak, 2018). Yet, access in the research setting is not only a practical matter, but provides insights into the “social organisation of the setting”, thus researchers need to ensure that access is not only permitted but also, in fact, practicable (Cohen, Manion, & Marrison, 2007). Cohen et al (2007) observe further that access might also be denied by the potential sample participants themselves for very practical reasons. For example, a teacher simply might not have the time to spend with the researcher, or people who have something to protect such as, a school which has recently received a very poor inspection result or poor results on external examinations.

Consequently, it is critical for researchers to consider not only whether access is possible but also how access will be undertaken – to whom does one have to go, both formally and informally, to gain access to the target group (Cohen, Manion, & Marrison, 2007). This might also necessitate that researchers acquire informed consent at all stages of the research in order to access the institutions or groups/persons/participants of the research and gain their acceptance before embarking on the study (Bryman, 2008; Patton, 2002). In the current study, research clearance was sought and granted by Mildmay Uganda Research Ethics Committee (MUREC)⁵, the Uganda National Council for Science and Technology (UNCST)⁶, the Norwegian Centre for Research Data (NSD)⁷, and acceptance⁸ was granted by the two participating institutions in order to ensure official access and permission to undertake the study.

In addition, the issue of confidentiality was provided for in the participant information sheet⁹ and informed consent¹⁰ sought from each of the participants before conducting interviews and classroom observations. During the interview sessions, each individual participant was given an opportunity to talk freely and anonymity would be assured to protect the identity of participants and institutions. Only with consent from a participant, the information gathered in form of interview recordings (written or audio) is published. Pseudonyms were used to replace all identities of participants and TTIs in the writing process, both in the articles and this thesis. Lastly, feedback was given to all participants who were interviewed by allowing each participant to check their transcribed interviews, and observation reports as suggested by Cohen et al. (2000). This helped to increase the validity and reliability (trustworthiness) of the findings.

More so, having worked for more than six years as teacher educator with one of the institutions where the research was conducted was anticipated to a certain degree influence the research findings. This is because some of the participants in the study also happened to have been former workmates at the institution. Silverman (2006) acknowledges that bias between the researcher's preconceptions and the research is a known problem. He adds that, extended involvement in a research field may produce questions about the researcher's own interpretation of 'their' tribe or Organisation. However, this limitation was lessened by keeping track of the

⁵ See Approval from Research Ethics Committee in Appendix 9

⁶ See UNCST Approval letter in Appendix 10

⁷ See NSD Approval letter in Appendix 11

⁸ See Acceptance letters in Appendices 7 (Kabwohe TTI) and 8 (Sheema TTI)

⁹ See Participant information sheet in Appendix 13

¹⁰ See Informed Consent form in Appendix 14

researcher's role (Fink, 2000) during and after data collection and analysis. For instance, during interviews focus was put on accessing participant's thoughts and feelings relating to the research questions. Although each participant was allowed to freely express their opinions, any data that did not address the present research questions was ignored or only used for reflection during or after the analysis.

5 Findings in the articles

As earlier noted in chapter one of this thesis, the study was planned to accomplish at least three articles based on the three research questions. This chapter presents a summary of findings from each of the articles. The order in which the three articles are presented is in accordance with the order research questions have earlier been presented in chapter one of this thesis.

5.1 Article I

Tusiime, W. E., Johannesen, M., & Guðmundsdóttir, G. (2019). The dilemma of teaching with digital technologies in developing countries: Experiences of art and design teacher educators in Uganda. *Nordic Journal of Comparative and International Education (NJCIE)*, 3(2), 55-71. <https://doi.org/10.7577/njcie.3313>

In this first article, we employ a case study design to explore how teacher educators use digital technologies in teaching Art and Design (A&D) subjects in a developing country. Based on transcribed data from interviews and classroom observations with ten teacher educators at two teacher training institutions in Uganda, we sought to understand the actual use of technologies by teacher educators in the A&D classroom. Data analysis was guided by concepts from the resources and appropriation theory (RAT) (van Dijk, 2005) and TPACK frame-work (Mishra and Koehler, 2006). The findings indicate that A&D TEs in Uganda only occasionally use digital technologies in basic and low creative means to teach in A&D classrooms. This may be attributed to insufficient access to adequate digital resources (hardware, software and internet), insufficient digital skills and knowledge relating to pedagogical use of digital technologies in A&D classrooms. Instead, A&D TEs use non-professional software like Microsoft Office to teach A&D subjects and employ personal digital devices such as mobile phones to access the Internet and communicate with students. The findings further confirm teacher educators' limited awareness of the relationship between technology, pedagogy and content knowledge (TPACK) when teaching A & D subjects. The lack of TPACK among A&D TEs in addition to insufficient access to digital resources and skills explains the low creative use of digital technologies in teaching A&D lessons in Uganda's TTIs.

5.2 Article II

Tusiime, W.E, Johannesen, M. & Gudmundsdottir, G. (2019). Developing Teachers' Digital Competence: Approaches for Art and Design Teacher Educators in Uganda. *International Journal of Education and Development using ICT*, 15(1)

The aim of this study was to establish an in-depth understanding of how art and design teacher educators (TEs) develop digital competences in teacher training institutions in Uganda. Based on a case study design, transcribed interviews from twenty four participants that included teacher educators, teacher trainees and administrators were analysed in relation to perspectives from van Dijk's resources and appropriation theory (RAT) as a conceptual lens. The findings indicate that art and design TEs develop digital competences through both formal and informal approaches¹¹. The formal approaches include *continuous professional development (CPD)* and *pre-service training*, whereas informal approaches include *collaboration*, *self-teaching* and *repetition*. Apparently, teachers' digital competences (TDC) gained through formal approaches did not relate specifically to the teaching of art and design subjects, making it inadequate and difficult to apply in real classroom practice. Further, the findings suggest to a larger extent that TEs develop moderate TDC, necessary for practical use in the classroom, through informal approaches. Through collaboration, TEs share knowledge and experiences and participate together with digitally competent persons to develop skills. Even without professional guidance, TEs develop skills on their own (self-teaching) through try and error, tutorials, Internet resources and the regular and routine (repetition) use of digital technologies. Finally, the findings confirm that TEs' inadequate physical access to digital resources limit the development of TDC.

5.3 Article III

Tusiime, W. E., Johannesen, M. & Gudmundsdottir, G. B. (2020) Teaching art and design in a digital age: challenges facing Ugandan teacher educators, *Journal of Vocational Education & Training*, 72(2). DOI: [10.1080/13636820.2020.1786439](https://doi.org/10.1080/13636820.2020.1786439)

The descriptive case study explores the motivation and material accessibility challenges that art and design (A&D) educators in Uganda encounter when teaching with digital technologies and examines how they cope with these challenges. Transcribed data collected from

¹¹ Formal approaches in the context of this study refer to organised and structured training systems with learning objectives in school or the workplace. On the other hand, informal approaches denote developing digital skills from daily experiences and interest.

participants (teacher educators and administrators) at two teacher training institutions (TTIs) in Uganda through interviews and classroom observations were analysed based on theoretical concepts from the resources and appropriation theory (van Dijk, 2005).

The findings indicate that A&D TEs face motivational challenges (linked to negative attitude, lack of self-confidence, lack of time, inadequate digital competence and fear for loss of creativity). It is noteworthy to see the diverse attitudes between self-reported data on motivation and teacher educators' actual use from the classroom observations. Although some TEs express negative attitude towards the use of technology, others align with the idea of using technology in education. Yet, when observing the TEs in the classroom, challenges regarding material access seem to overshadow the intentions of being a part of a digitalized society. The challenges related to material access revealed in this study are typical for countries that dedicate less means to invest in what is necessary for robust technological infrastructure (e.g. lack of adequate access to digital technologies, unreliable electricity supply, technological failures and lack of adequate technical support). Thus, access to technological infrastructure varies. In an ideal situation both access to relevant digital tools and internet connection is in place. However, in practice the reality is often different. Lack of proper technological infrastructure can further influence not only opportunities to use and motivation to use but also attitudes and the general digital competence of teachers.

The study findings also indicate that A&D educators have used alternative strategies such as peer support, continual practice, improvisation, lobbying for technical and financial support, and advocating for BYOD to cope with the existing challenges. These coping strategies, such as the fact that TEs need to use personal equipment like private cell phones to access digital material and the internet, may indicate that there is a lack of clear institutional policy and implementation plan of digital tools in the A&D education programmes in this study. Furthermore, use of personal equipment to weight up for limited institutional access can be seen as reinforcing existing societal inequalities and unequal distribution of resources. Moreover, the findings imply that Ugandan TEs do not get the desired opportunities to use digital technologies in A&D classrooms but are well aware of its relevance. As such, the potential of digital technology is not fully utilised due to existing challenges reported in this study.

6 Discussion, Implications and Conclusion

This chapter discusses the most significant findings across the articles in relation to the research questions, previous research, theory and methodology. The chapter has three sections. The first section reviews the study's research questions in relation to the main empirical findings presented and discussed extensively in articles I, II and III¹². The second section discusses the findings and provides the implications and/or suggestions whereas concluding remarks and how the present study contributes to the prior existing research in the field are given in the third section.

6.1 Reviewing the research questions

First and foremost, the main aim of present study was to contribute with insights into teacher educators' digital competence in teaching Art and Design subjects in teacher training institutions (TTIs) in Uganda. To accomplish this aim, the following research questions guided the study:

RQ1: In what ways are teacher educators using digital technology when teaching art and design in Uganda?

RQ2: How do art and design teacher educators develop their digital competence in Teacher Training Institutions in Uganda?

RQ3: What challenges do teacher educators encounter when teaching art and design with digital technology in Uganda?

On the basis of these research questions, a summary of findings from three research articles (*referred to in this thesis as; Article I, II and III respectively*) each addressing one of the research questions (RQs) has earlier been presented in the previous chapter under sections 5.1, 5.2 and 5.3 respectively. It is important to note that some aspects in the three RQs are addressed in all the three articles as cross cutting issues. For example, some of the challenges encountered by TEs in the process of teaching with digital technologies addressed in Article III are also discussed in articles I, II. Table 7 provides an overview of the three articles with respect to their titles, the research question (RQ) each article addresses, guiding questions, empirical data and the main findings.

¹² See Appendices 1, 2 and 3 for Published versions of Articles I, II and III respectively.

Table 7: Overview of articles, corresponding RQs, methods and main findings

Article No.	Title	Research Question (RQ)	Guiding question	Empirical data	Main findings
I.	The dilemma of teaching with digital technologies in developing countries: Experiences of art and design teacher educators in Uganda	RQ1	How do Ugandan teacher educators (TEs) use digital technology in teaching art and design (A&D)?	Transcripts of 10 individual interviews and observations	-Occasional <i>use</i> of digital technologies -low digital competence -insufficient <i>access</i> to digital technologies -TEs' possess limited <i>awareness</i> of the relationship between technology, pedagogy and content.
II.	Developing teachers' digital competence: approaches for Art and Design teacher educators in Uganda	RQ2	How do art and design TEs develop digital competence for teaching in TTIs in Uganda?	Transcripts of 24 individual interviews and observations	<i>Formal approaches:</i> -continuous professional development -pre-service training. <i>Informal approaches:</i> -collaboration, -self-teaching -repetition.
III.	Teaching art and design in a digital age: Challenges facing Ugandan teacher educators	RQ3	What motivational and material challenges do TEs encounter when teaching A&D with digital technologies and how do TEs cope with such challenges in Uganda?	Transcripts of 14 individual interviews and observations.	<i>Motivational:</i> negative attitude, self-confidence, time, digital competence, loss of creativity. <i>Material:</i> digital resources, power supply, technical support. <i>Copying strategies:</i> peer-peer support, constant practice, lobbying for technical & financial support, BYOD.

From table 7, RQ1 addresses the usage aspect of technology in this study and it is answered in Article I. Secondly, RQ2 sought to understand how TEs develop digital competence and this aspect is addressed in Article II which discusses the different approaches through which art and design TEs develop digital competence for teaching purpose. Lastly, RQ3 focuses on the challenges art and design TEs encounter in teaching with digital technologies and this aspect is thoroughly addressed in Article III.

6.2 Discussion and Implications

To begin with, the first research question (RQ1) in this study was to understand in what ways TEs use digital technology to teach art and design in Uganda. The present study found that TEs occasionally use digital technologies in limited creative ways (basic use) to teach in A&D classrooms, and educators possess limited awareness of the relationship between technology, pedagogy and content knowledge -TPACK (*Article I*). This may be partly attributed to inadequate digital competence and insufficient access to digital resources (hardware, software and the Internet) as discussed in details in Article III (challenges) and highlighted as crosscutting issues in articles I and II (*see Appendix 1 and 2*) of this thesis.

The present findings seem to be consistent with previous studies (Bagarukayo, 2018; Nakintu & Neema-Abooki, 2015; Andema, Kendrick, & Norton, 2013) in teacher education which have also reported the limited use of digital technology in Uganda's teacher education programmes. Brinkerhoff (2006) observed that teachers often fail to fully adopt technology use in their classroom practice due to inadequate technological training and experience in technology use (digital competence), insufficient digital resources, attitudinal or personality factors and institutional and administrative support. Indeed, Tulinayo, Ssentume, & Najjuma (2018) concur and add that many educators especially in resource constrained countries and institutions of learning still do not consider or use digital technologies.

Besides, Koehler, Mishra, Akcaoglu, & Rosenberg (2013) observe that teaching creatively with the aid of technology requires teacher educators to synthesize their knowledge of technology, pedagogy and content and to apply it to the design of learning experiences. Regrettably, A&D TEs in Uganda seem not to be fully aware of this relationship and the possibilities the TPACK can offer in improving the quality of teaching A&D with technology. As illustrated in table 8 which is based on the present study's findings highlighted earlier in the previous sections and detailed in the articles (*Appendices 1, 2 and 3*), it can be put that TEs limited awareness and application of the TPACK in the teaching process could largely be influenced by the challenges encountered by the TEs. To illustrate this, Table 8 shows how kinds of access described in the RAT theory support or hinder the development of TPACK related to the themes addressed by the RQs. For instance, from table 8, it can be noted that the insufficient access to digital technologies (*material access*) and insufficient digital skills (*skills access*) could be deterring factors for TEs failure to prepare TPACK lesson plans or creatively

use appropriate technology (*usage access*) with relevant pedagogical approaches to demonstrate complex art and design concepts to the students. Also as indicated in table 8, the high motivation (*motivational access*) demonstrated by TEs only seem to enable TEs to occasionally teach with digital technologies.

Table 8: The TPACK framework in relation to the RQs

	TPACK Components						
	TK	CK	PK	TCK	TPK	PCK	TPCK
RQ1: Technology application	-TEs occasionally use (<i>usage access</i>) digital technologies to support teaching in A&D -TEs are highly motivated (<i>motivational access</i>) to use digital technologies.			-Limited use of technology (<i>usage access</i>) to demonstrate complex A&D concepts.	-TEs use technology (<i>usage access</i>) to support student learning approaches for the lesson taught.		- Low creative use (<i>usage access</i>) of technologies in teaching A&D concepts, i.e. No relationship between technology, pedagogical approaches and the content being taught.
RQ2: TEs digital competence /skills /knowledge	-TEs use digital tools with some difficulties. -TEs possess knowledge (<i>skills access</i>) about a variety of technologies	-TEs exhibit good knowledge of the A&D subject	-TEs demonstrate understanding of different pedagogical approaches in teaching A&D			-TEs combine different pedagogical approaches in teaching A&D content	-limited awareness of the TPACK (<i>skills access</i>)
RQ3: Challenges	-Insufficient access to digital technologies (<i>material access</i>) -Insufficient digital skills access				-TEs not well prepared with lesson plans (<i>lack skills access</i>).		- TEs not well prepared with TPACK lesson plans (<i>i.e. lack of both skills and usage access</i>).

Although A&D TEs in Uganda are highly motivated to use technology and have sufficient knowledge about a variety of digital technologies (not digital competence) and demonstrate understanding of different pedagogical approaches in addition to good knowledge of the A&D

content, this seems not to be sufficient in the application of TPACK in teaching A&D. Similarly, Apau (2017) indicated in his study that, although student-teachers reported to have the ability to accept and use a variety of technologies and had sufficient content and pedagogical knowledge, student-teachers were ambivalent about their ability to solve problems they encountered when using technology. Thus, Apau (2017) suggests that, teaching in today's classrooms should not only be dependent on the content and pedagogical knowledge of the teacher as it were but also, on the technological knowledge and the teacher's ability to use technologies for instructional-related purposes in and out of the classroom. In addition, based on the present findings, it is important that teacher educators are given the necessary support to enable them interact and work with technologies in teacher training institutions. This could help educators in improving their TPACK and abilities to apply such knowledge in their pedagogical practices.

The findings in relation to research question one (RQ1) imply that desired learning outcomes mediated by the use of digital technologies may be greatly impeded, and that TEs face an ongoing dilemma in teaching without proper access to digital technologies in Uganda. There is need to address the digital divide that currently exists due to insufficient access to digital technologies and digital skills in Ugandan TTIs so as to increase the diverse usage of digital technologies in A&D classrooms. This could be done through a renewed policy focus at both institutional and national levels. Such policies could have specific focus the pedagogical use of digital technologies in teacher training institutions. The 'digital technology pedagogical policies' could further be used by educators and curriculum developers in teacher training institutions to guide the development of subject-specific curriculum, reviews and lesson plans that are TPACK compliant and address the technological student-learning needs in the 21st century in fields like art and design. In addition, the lack of TPACK among TEs explains the limited creative use of digital technologies in teaching A&D in TTIs in Uganda and has an important implication for developing A&D TEs' TPACK competence to improve the creative use of digital technologies in A&D classrooms.

Secondly, research question two (RQ2) of this study required to understand how A&D teacher educators develop digital competence in Uganda. The findings of this study indicate that TEs develop digital competences through both formal and informal approaches. The formal approaches include *continuous professional development (CPD)* and *pre-service training*, whereas informal approaches include *collaboration, self-teaching and repetition*. Apparently,

teachers' digital competences (TDC) gained through formal approaches did not relate specifically to the teaching of art and design subjects, making it inadequate and difficult to apply in real classroom practice. Surprisingly, the findings suggest to a larger extent that TEs develop moderate digital competences, necessary for practical use in the classroom, through informal approaches.

The present findings resonate with van Dijk's (2005, p. 90) study where he indicates that "computer courses and books are not the most important sources for learning computer skills". While van Dijk underscores the importance of formal education in setting a solid basis for digital skill development, the present findings clearly show a mismatch between formal education and digital skills access in Uganda's art and design education. With formal ICT courses in this study being distinct rather than an integral part of art and design subjects' curricula, they provide only moderate competence in using software and hardware. Moreover, Lund et al. (2014) posit that developing TDC in teacher education does not solely involve educating teachers how to understand and use various emerging technologies that are relevant to their professional practice. Instead, developing TDC involves the ability to make teachers capable of using digital technology and learning resources in productive ways to transform their knowledge into discipline-specific didactics, classroom management, and assessment of how students make productive use of available digital resources (Lund et al., 2014). Similarly, previous studies also indicate that, collaborative approaches (Røkenes & Krumsvik, 2014; Laurillard, 2009) and other informal approaches such as; continuous practice (repetition) (Agyei & Voogt, 2011; Drent & Meelissen, 2008) have been reported to enable student teachers to easily acquire new knowledge and competences, which later are used to create new meaning.

However, taking into account the inadequate physical access to digital resources at both TTIs as well as the inadequate or non-existent professional guidance within informal approaches reported in this study (*refer to details in Article II in Appendix 2*), it is evident that A&D TEs will continue to find it difficult to fully develop the operational, informational and strategic skills (van Dijk, 2005) that are required to develop appropriate TDC. In this case, the findings suggest the need for future TTIs in Uganda to implement a curriculum that can help realise operational, informational and strategic skills. These skills must be fully integrated into all traditional art and design subjects to create a subject-specific digital curriculum to enable the development of the TDC required to use digital technologies in the classroom.

Lastly, research question three (RQ3) of this study sought to understand what challenges teacher educators encounter when teaching art and design with digital technology in Uganda. The current study found that, TEs are faced with numerous motivational challenges (linked to negative attitude, lack of self-confidence, lack of time, inadequate digital competence and fear for loss of creativity) and challenges related to material access such as; lack of adequate access to digital technologies, unreliable electricity supply, technological failures and lack of adequate technical support (*read details in Article III – Appendix 3*).

The challenges as reported in this study seem not to only apply to Ugandan context but are also the case in other developing and more affluent countries according to previous studies. Studies conducted in developing countries (Al-Azawei1, Parslow, & Lundqvist, 2016; Bonsu, Duodu, Ansere, & Djang-Fordjour, 2013; Madlela, 2015; Andersson, 2008) indicate that even though computers and other technologies are common, developing countries are not enjoying their benefits due to certain challenges such as inadequate access to technologies like computers, inadequate financial support for purchasing the technology, lack of training for educators and inadequate motivation for educators to adopt digital teaching tools. In Uganda, Tulinayo, Ssentume, & Najjuma, (2018) found in their study that, one of the limiting factors for the use and acceptance of digital technologies by educators is the limited access to digital technologies in institutions of learning. Even in affluent countries like Norway, there are still accessibility challenges due to an emerging digital divide in urban schools (Hatlevik & Gudmundsdottir, 2013). Similarly, Ragnedda & Muschert (2013) present several studies conducted in highly developed, rapidly developing and under-studied nations and regions on the complexity of digital divide inequalities in terms of access to the internet and other physical and social digital infrastructure. The findings reported in these studies resonate broadly with those in the present study even though the disparities in terms of challenges in developing countries like Uganda are higher than those in affluent nations like the USA and Norway. For instance, the lack of proper digital infrastructure (hardware, software, and internet) reported in the present study so as previous studies can further influence not only opportunities and motivation to use digital technologies in the A&D classrooms but also attitudes and the general digital competence of teacher educators.

Moreover, the findings imply that Ugandan TEs do not get the desired opportunities to use digital technologies in A&D classrooms but are well aware of its relevance. As such,

the potential of digital technology is not fully utilised due to existing challenges reported in this study. Consequently, there is an urgent need to address the digital divide that currently exists through the identified challenges in Ugandan TTIs to improve the teaching of A&D with digital technologies. This could be done through renewed institutional and national levels ICT in education policies, strategic implementation plans as well as investment in digital infrastructure.

6.3 Conclusion and contributions

The ensuing subsections provide the concluding remarks, contributions of the research, recommendations for practice, limitations and areas for further research.

6.3.1 Concluding remarks

The main aim in the present study was to contribute with insights into teacher educators' digital competence in teaching Art and Design subjects in teacher training institutions (TTIs) in Uganda. To attain this goal, three research articles (*referred to in this thesis as Article I, II and III*) were published each providing answers to one of the three research questions (i.e. RQ1, RQ2, RQ3). A comprehensive presentation and discussion of the general findings was done in each of the published articles (*See Appendices 1, 2 and 3 for full versions of all the three published articles*). The summary of the main findings in each of the articles is presented in chapter five (5.1, 5.2, 5.3), reviewed in relation to the corresponding study's research questions (RQ1, RQ2, RQ3) in chapter six (6.1) and the main findings discussed under 6.2. Accordingly, this study has generally found out that, teacher educators' digital competences (TDC) remained operational and were not specific to the teaching of art and design subjects, thus being inadequate and difficult to apply in real art and design classroom practice. Due to numerous motivational and material challenges encountered by TEs in addition to limited awareness of the relationship between technology, pedagogy and content knowledge (TPACK), TEs can only occasionally use digital technologies in limited creative ways (basic use) to teach in Ugandan A&D classrooms.

6.3.2 Research contributions

The findings from the present study make three main contributions. First, the present study confirms previous findings and provides additional evidence to a growing body of literature with respect to teachers' digital competence, technology use and/or integration in A&D teacher

education and related challenges and coping strategies. Specifically, the study has gone some way towards enhancing our understanding of how art and design TEs develop digital competences, use and/or integrate digital technologies in art and design teacher education and the challenges A&D TEs encounter when teaching with digital technologies in a developing country like Uganda.

Secondly, the application of van Dijk's resources and appropriation theory (RAT) in this study to scrutinize among others two particular concepts of the model (motivational and material access), without focusing on the successive nature of the concepts in the original model (*see figure 2 – chapter 3*), has illustrated that the successiveness of the model is not necessarily linear, but rather interconnected. For example, is it difficult to explain motivational access without considering both material access and skills access. This theoretical finding suggests that the employment of the RAT theory should be less bound to the successive stages and more on the interconnected nature of it (*see Article 1-Appendix 1*).

Thirdly, by merging perspectives from two theoretical models (i.e. RAT and TPACK) to closely examine the research questions and analyze the data, the present study has contributed theoretical concepts and methodological tools that can be used to produce a series of perspectives at the micro-level with which to explain empirical outcomes in related studies. This contribution further implies that ontological and epistemological issues may give way to considerations of the most appropriate way to design research (the methodological question) in related field.

6.3.3 Recommendations for practice

Based on the findings in the present study, a number of significant recommendations for future practice to different stakeholders in the A&D teacher education programme in Uganda are as follows:

First, the Government of Uganda through the Ministry of Education and Sports in collaboration with experts from its development partners and TTIs urgently need to review the existing National ICT policy in education and strategic plans or formulate appropriate and operational ICT policies, conceptions, strategies, plans and models to guide the integration of digital technologies in teacher education at both national and institutional levels. The policies need to have a focus on the pedagogical integration of digital and or emerging technologies in teacher training programmes and guide the development, implementation and evaluation of

subject-specific teacher training curricula in TTIs. Conversely, such policies and procedures are not only essential for teacher's successful utilization of new digital technologies in training institutions but also instrumental in the successful implementation of other technology-enhanced institutional strategic plans.

Second, there is need for both government and TTIs to address the digital divide that currently exists due to insufficient access to digital technologies and digital skills in Ugandan TTIs so as to increase the diverse usage of digital technologies in the classrooms by both teacher educators and students. Both the government and TTIs must prioritize investment in digital infrastructure such as installation of more art and design-specific hardware, software and the Internet (*with higher bandwidth at low cost*), construct digital art studios/labs and e-learning digital infrastructure to cater for large number of students in TTIs and provide for distance learning. Such intervention will also help to support technology-enhanced education that is more needed than before due the prevailing digital demands in the 21st century and challenges such as the viral global pandemics such as Covid-19 that has recently sterilized the education sector. Improving access to digital technologies in Uganda's TTIs is further likely to address other challenges related to motivational and material access as earlier discussed in the present study.

Third, it is recommended that TTIs provide continuous professional development opportunities to educators through regular hands-on digital skills trainings and exposure to new digital resources for them to become regular users of digital technologies. Based on the study findings, it is necessary that such technology-enhanced trainings geared at developing teachers' digital competence (TDC) enable educators realize not only operational skills (*skills used to operate computers and their network hardware and software*), but also information skills (*skills needed to search, select, process and evaluate information in computer and network sources*), and the strategic skills (*capacities to use digital sources to achieve specific and general goals of improving one's position in society*). These skills must be fully integrated into all traditional art and design subjects to create a subject-based digital curriculum to enable educators develop the TPACK and abilities to apply such knowledge (digital competence) in their pedagogical practices. In addition, TTIs should urgently consider integrating the strength of informal approaches such as collaboration, self-teaching and repetition (*refer to Article II, Appendix 2*) to the development of TDC into formal art and design education curricula.

Finally, this study recommends that A&D TEs and TTIs collaborate and partner with other digitally competent colleagues and successful technology-enhanced partner institutions respectively in a bid to acquire best practices, develop digital competences and accelerate the integration of digital technologies in teaching as well as reduce duplication of resources. This could be through the development and sharing of e-content and other resources, funding, training personnel and digital infrastructure development.

6.3.4 Limitations and further research

The current study only examined the development of teacher educators' digital competence (TDC) in terms of access (i.e. motivation, material, skills/knowledge and usage) to digital technologies as necessary requirements for educators to effectively appropriate digital technologies in the art and design classrooms. However, van Dijk (2005) argues that, even though sufficient motivation, physical access to digital technologies and the skills/knowledge to apply them are necessary, they may not be sufficient conditions for the actual use of such technologies. It would therefore be interesting to investigate if there conditions/factors necessary to facilitate the development of teacher educators digital competence in teacher education programmes in developing countries.

In addition, the present study throughout its three articles (*see appendices 1, 2 and 3*), only explored the accessibility challenges (in terms of physical, motivational, skills and usage) encountered by A&D TEs and addressed issues related to how TEs and TTIs in Uganda mitigated these challenges. Further research should seek to identify challenges encountered by other stakeholders such as the students, teacher training institutions and the government. This could be in relation to integration of digital technologies in teacher education programmes such as art and design or the development of educators' or professional digital competence.

Lastly, it would be interesting to conduct comparative studies in other teacher education programmes in Uganda as well as related studies in other developing and developed countries to contribute to existing body of knowledge in the research area as well as broaden understanding of the field for future improvement.

References

- Abass, B. T. (2011). Computer Instructional Approach and Students' Creative Ability in Sculpture Education in Nigeria Universities: Obafemi Awolowo University as a Case Study. *World Journal of Education, 1*(2), 130-135.
- Agyei, D., & Voogt, J. (2011). Exploring the potential of the will, skill, tool model in Ghana: Predicting prospective and practicing teachers' use of technology. *Computers & education, 56*(1), 91-100. doi:10.1016/j.compedu.2010.08.017
- Aladejana, F., & Idowu, L. (2009). Using a Computerised Graphics Package to Achieve a Technology-Oriented Classroom. *Policy Futures in Education, 7*(4), 439-444.
- Al-Azaweil, A., Parslow, P., & Lundqvist, K. (2016). Barriers and Opportunities of E-Learning Implementation in Iraq: A Case of Public Universities. *International Review of Research in Open and Distributed Learning, 17*(5), 126-146.
- Andema, S. (2009). *Digital literacy and teacher education in Uganda: The case of Bondo Primary Teachers' College*, . Vancouver.: unpublished M.A dissertation, Faculty of Education, University of British Columbia.
- Andema, S. (2014). *Promoting Digital Literacy in African Education: ICT Innovations in a Ugandan Primary Teachers' College*. Vancouver: University of British Columbia.
- Andema, S., Kendrick, M., & Norton, B. (2013). Digital literacy in Ugandan teacher education: Insights from a case study. *Reading & Writing, 4*(1), 1-8. Retrieved May 2019, from <http://dx.doi.org/10.4102/rw.v4i1.27>
- Andersson, A. (2008). Seven major challenges for e-learning in developing countries: Case study eBIT, Sri Lanka. *International Journal of Education and Development Using Information and Communication Technology., 4*(3), 45-62.
- Anthony, G. M. (2013). *Perspectives on ICT adoption in Ugandan Schools*. Houghton, Michigan: Michigan Technological University.
- Apau, S. K. (2017). Technological Pedagogical Content Knowledge Preparedness of Student-Teachers of the Department of Arts and Social Sciences Education of University of Cape Coast. *Journal of Education and Practice, 8*(10), 167-181. Retrieved May 2019, from <https://files.eric.ed.gov/fulltext/EJ1139820.pdf>
- Appiah, E., & Cronjé, J. C. (2012). Thumbnail sketches on idea development: The drawing board vs computer generation. *Art, Design & Communication in Higher Education, 11*(1), 49-61. doi:10.1386/adch.11.1.49_1

- Bagarukayo, E. (2018). Social Media Use to Transfer Knowledge into Practice and Aid Interaction in Higher Education. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 14 (2), 210-231.
- Barriball, K., & White, A. (1994). Collecting data using a semi-structured interview: a discussion paper. *Journal of Advanced Nursing*, 19, 328-335. Retrieved May 2019, from <https://doi.org/10.1111/j.1365-2648.1994.tb01088.x>
- Bastos, F. (2010). Editorial: New media art education. *Art Education*, 63(1), 4-5.
- Bernard, R. M., Borokhovski, E., Schmid, F. R., Tamim, R. M., & Abrami, P. C. (2014). A meta-analysis of blended learning and technology use in higher education: from the general to the applied. 1-36: J Comput High Educ DOI 10.1007/s12528-013-9077-3.
- Black, J., & Browning, K. (2011). Creativity in Digital Art Education Teaching Practices. *Art Education*, 19-34. Retrieved May 2019, from <https://doi.org/10.1080/00043125.2011.11519140>
- Boddy, C. (2016). Sample size for qualitative research. *Qualitative Market Research*, 19(4), 426-432. Retrieved from <https://doi.org/10.1108/QMR-06-2016-0053>
- Bonsu, K., Duodu, A., Ansere, J., & Djang-Fordjour, K. (2013). The Challenges and Prospects of ICTs in Teaching and Learning in Sunyani Polytechnic, Ghana. *Common Wealth Association of Politechnics in Africa*, 1(1), 12-17. Retrieved from www.capa-sec.org
- Boote, D. N., & Beile, P. (2008). Scholars before researchers: On the centrality of the dissertation literature review in research preparation. *Educational Researcher*, 34(6), 3-15. doi:10.3102/0013189X034006003
- Brandtzaeg, P., Heim, J., & Karahasanovic, A. (2011). Understanding the new digital divide - A typology of Internet users in Europe. *International Journal of Human-Computer Studies*, 69(3), 123-138. doi:10.1016/j.ijhcs.2010.11.004
- Brinkerhoff, J. (2006). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration and beliefs. *Journal of Research on Technology in Education*, 39(1), 22-43. Retrieved May 2019, from <https://files.eric.ed.gov/fulltext/EJ768867.pdf>
- Bryman, A. (2008). *Social Research Methods*. (3rd ed.). New York: Oxford University Press.
- Burnard, P., Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Analysing and presenting qualitative data. *British Dental Journal*, 204(8), 429-432. doi:10.1038/sj.bdj.2008.292
- Carminati, L. (2018). Generalizability in Qualitative Research: A Tale of Two Traditions. *Qualitative Health Research*, 1-8. doi:doi.org/10.1177/10497323187883

- Clarence, S. (2017, December 7). Writing a Literature review in your own 'voice' [Blog post]. Retrieved from <https://phdinahundredsteps.com/tag/using-literature-in-your-thesis/>
- Cohen, D., & Crabtree, B. (2006, 07). *Qualitative Research Guidelines Project*. Retrieved from Robert Wood Johnson Foundation: <http://www.qualres.org/HomeSemi-3629.html>
- Cohen, L., Manion, L., & Morrison, K. (2007). *Research Methods in Education* (6th ed.). London: Routledge. Retrieved from <https://gtu.ge/Agro-Lib/RESEARCH%20METHOD%20COHEN%20ok.pdf>
- Cohen, L., Manion, L., & Morrison, K. (2000). *Research Methods in Education* (5th ed.). London: Routledge Falmer.
- Cress. (2013). The Digital Domain: Using Today's Technologies to Inspire Engaging Classroom Experiences. *Art Education*, 40- 45.
- Creswell, J. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage.
- Delacruz, E. (2009). Old World Teaching Meets the New Digital Cultural Creatives. *JADE*, 28(3), 261-268.
- Denzin, N. K., & Lincoln, Y. S. (2005). *The Sage handbook of qualitative research*. (3rd ed.). London, New Delhi: Sage Publications.
- Donahoo, S., & Whitney, M. (2006). Knowing and getting what you pay for: Administration, technology, and accountability in K-12 schools. In S. Y. Tettegah, & R. Hunter, *Technology and Education: Issues in Administration, Policy, and Applications in K12 Schools Advances in Educational Administration*. (Vol. 8, pp. 125-142). Elsevier.
- Dorgu, T. E. (2015). Different Teaching Methods: A Panacea for Effective Curriculum Implementation in the Classroom. . *International Journal of Secondary Education. Special Issue: Teaching Methods and Learning Styles in Education. Vol. 3, No. 6-1. doi: 10.11648/j.ijsedu.s.2015030601.13*, 77-87.
- Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? . *Computers and Education*, 55(1), 187-199.
- Dwyer, S. C., & Buckle, J. L. (2009). The Space Between: On Being an Insider-Outsider in Qualitative Research. *International Journal of Qualitative Methods*, 8(1), 54-63.
- Dziuban, C., Hartman, J., & Moskal, P. (2004). Blended Learning . *Educause Centre for Applied Research* (7).

- Engida, T. (2011). *ICT-enhanced Teacher Development Model*. . Addis Ababa, Ethiopia.: UNESCO-IICBA. United Nations Economic Commission for Africa.
- European Commission. (2007). *Key competences for lifelong learning. European reference framework*. Luxembourg: Office for Official Publications of the European Communities.
- Farrell, G. (2007). *Survey of ICT in Education in Uganda*. . Washington, DC: infoDev/World Bank.
- Farrell, G., & Isaacs, S. (2007). *Survey of ICT and Education in Africa: A Summary Report Based on 53 Country Surveys*. Washington, DC: infoDev / World Bank. Retrieved 6 8, 2019, from <http://www.infodev.org/en/Publication.353.html>
- Ferrari, A. (2012). *Digital Competence in Practice: An analysis of frameworks*. Luxembourg: Joint Research Centre of the European Commission. doi: doi:10.2791/82116
- Ferrari, A. (2013). *DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe*. Luxembourg: Joint Research Centre of the European Commission.
- Fink, A. S. (2000). The Role of the Researcher in the Qualitative Research Process. A Potential Barrier to Archiving Qualitative Data. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 1(3), 69 paragraphs. Retrieved from <http://nbn-resolving.de/urn:nbn:de:0114-fqs000344>.
- Firestone, W. A. (1993). Alternative arguments for generalizing from data as applied to qualitative research. *Educational Researcher*, 22, 16–23. doi:10.2307/1177100
- Freeman, B., & Hawkins, R. (2017). *Evoke—Developing Skills in Youth to Solve the World’s Most Complex Problems: Randomized Impact Evaluation Findings*. Washington, DC: The World Bank. Retrieved from : <http://saber.worldbank.org>
- Gall, M. D., Borg, W. R., & Gall, J. P. (2003). *Educational research: An introduction* (7th ed.). White Plains, NY: Longman Publisher.
- Garrison, D., & Vaughan, N. (2008). *Blended Learning in Higher Education: Framework, Principles and Guidelines*. San Francisco: Jossey-Bass.
- Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal*, 204(6), 291-295. doi:10.1038/bdj.2008.192
- Glenna, B. O. (2008). Naturalistic inquiry and the saturation concept: a research note. *Qualitative Research*, 8(1), 137-152. doi:10.1177/1468794107085301

- Golafshani, N. (2003). Understanding Reliability and Validity in Qualitative Research. *The Qualitative Report.*, 8(4), 597-606. Retrieved from <https://nsuworks.nova.edu/tqr/vol8/iss4/6>
- Gough, D., Thomas, J., & Oliver, S. (2012a). Clarifying differences between review designs and methods. *Systematic Reviews*, 1(28), 1-9. doi:10.1186/2046-4053-1-28
- Gough, D., Thomas, J., & Oliver, S. (2012b). *An introduction to systematic reviews*. London: SAGE.
- Graham, A., & Jenny, H. (2010). *Pedagogic Approaches to Using Technology for Learning*. . UK : Lifelong learning .
- Gudmundsdottir, G. B. (2010b). *From digital divide to digital opportunities? A critical perspective on the digital divide in South African schools*. University of Oslo, Faculty of Educational Sciences. Oslo: University of Oslo.
- Gudmundsdottir, G., & Vasbø, K. (2017). Toward Improved Professional Digital Competence: The Use of Blended Learning in Teacher Education in Norway. In P. Resta, & S. (. Smith, *Proceedings of Society for Information Technology & Teacher Education International Conference 2017* (pp. 499-509). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).
- Gudmundsdottir., G. (2010a). From digital divide to digital equity: Learners' ICT competence in four primary schools in Cape Town, South Africa. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 6(2), 84-105.
- Harvey, D. M., & Ronald, C. (2016). Building TPACK in Preservice Teachers Through Explicit Course Design. *Association for Educational Communications & Technology*, 61(1), 106–114. doi:10.1007/s11528-016-0120-x
- Hatlevik, O., & Gudmundsdottir, G. (2013). An emerging digital divide in urban school children's information literacy: Challenging equity in the Norwegian school system. *First Monday*, 18(4). Retrieved from <https://firstmonday.org/ojs/index.php/fm/article/download/4232/3641>
- Hennessy, S., Onguko, B., Harrison, D., Kiforo Ang'ondi, E., Namalefe, S., Naseem, A., & Wamakote, L. (2010). *Developing the Use of Information and Communication Technology to Enhance Teaching and Learning in East African Schools: Review of the Literature*. East Africa: Centre for Commonwealth Education & Aga Khan University Institute for Educational Development – Eastern Africa Research Report No. 1.

- Hew, K. F. (2007). Integrating technology into k-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology, Research and Development*, 55, 223-252.
- Insterfjord, E. (2014). Appropriation of Digital Competence in Teacher Education. *Nordic Journal of Digital Literacy*, 313-329.
- Isaac, S., & Michael, W. B. (1995). *Handbook in research and evaluation: A collection of principles, methods, and strategies useful in the planning, design, and evaluation of studies in education and the behavioral sciences*. (3rd ed.). San Diego: EdITS Publishers.
- Johannesen, M., Øgrim, L., & Giæver, T. H. (2014). Notion in motion: Teachers' digital competence. *Nordic Journal of Digital Literacy*, 9 (4), 300-312.
- Kawulich, B. (2005). Participant Observation as a Data Collection Method [81 paragraphs]. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 6(2), Art.43. Retrieved from <http://nbn-resolving.de/urn:nbn:de:0114-fqs0502430>.
- Keengwe, J., & Kang, J. (2013). Blended learning in teacher preparation programs: A literature review. *International Journal of Information and Communication Technology Education*, 18(1), 479-493.
- Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70., 9(1), 60-70. Retrieved from <http://www.citejournal.org/volume-9/issue-1-09/general/what-is-technological-pedagogicalcontent-knowledge>
- Koehler, M. J., Mishra, P., Bouck, E., DeSchryver, M., Kereluik, K., Shin, T., & Wolf, L. (2011). Deep-play: Developing TPACK for 21st century teachers. *International Journal of Learning Technology*, 6(2), 146-163. doi:10.1504/IJLT.2011.042646
- Koehler, M., & Mishra, P. (2008). Introducing TPACK. . In *AACTE Committee on Innovation and Technology (Ed.), The handbook of technological pedagogical content knowledge (TPCK) for educators*. (pp. 3-29). Mahwah, NJ: Lawrence Erlbaum Associates. .
- Kotrlik, J. W., & Redmann, D. H. (2009). Technology Adoption for Use in Instruction by Secondary Technology Education Teachers. *Journal of Technology Education*, 21(1), 44-59. Retrieved May 2019, from <https://scholar.lib.vt.edu/ejournals/JTE/v21n1/pdf/kotrlik.pdf>
- Kvale, S. (1996). *InterViews. An introduction to qualitative research interviewing*. . Thousand Oaks London : Sage Publications.

- Laurillard, D. (2009). The pedagogical challenges to collaborative technologies. . *International Journal of Computer-Supported Collaborative Learning*, 4 (1). Retrieved from <http://dx.doi.org.ezproxy.hioa.no/10.1007/s11412-008-9056-2>, 5-20.
- Lemon, N. (2015). Integrating digital technology into the K-12 classroom: Arts Education Insights. In N. Lemon, *Revolutionizing Arts Education in K-12 Classrooms through Technological Integration*. (pp. xiii -xxii). Chocolate Avenue Hershey PA: IGI Global.
- Lin, C. (2011). A Learning Ecology Perspective: School Systems Sustaining Art Teaching with Technology. *Art Education*, 12-18. Retrieved May 2019, from <https://doi.org/10.1080/00043125.2011.11519131>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. . Beverly Hills, CA: Sage.
- Lund, A., Furberg, A., Bakken, J., & Engelién, K. L. (2014). What Does Professional Digital Competence Mean in Teacher Education? . *Nordic Journal of Digital Literacy*, 9 (4), 281-299.
- Luwangula, I. (2011). *Equipping Teachers with ICT Skills for Pedagogical Integration in Uganda: An Evaluation of Policy Implementation in Jinja Municipality*. Shanghai,China: East China Normal University (International Center of Teacher Education). Retrieved May 2019, from <https://www.grin.com/document/200562>
- Madlela, B. (2015). ICT Opportunities and Threats in Implementing Teaching Practice Programmes. *Universal Journal of Educational Research* , 3(6), 351-358. Retrieved from <http://www.hrpub.org>
- Magambo, J. (2007). *Use of Information and Communications Technologies (ICTs) in teacher education in Sub-Saharan Africa: case studies of selected African universities. PhD thesis* . Köln: Universität zu Köln.
- Marner, A., & Örtégren, H. (2013). Four approaches to implementing digital media in art education. *Education Inquiry* , 4(4), 671-688. doi:10.3402/edui.v4i4.23217
- Matunga, M. (2007). *Uganda Develops Curriculum-Based ICT Learning Materials*. Retrieved from <http://www.microsoft/education/partnersinlearning>.
- Mayer, R., Lee, H., & Peebles, A. (2014). Multimedia Learning in a Second Language: A Cognitive Load Perspective. *Wiley Online Library (wileyonlinelibrary.com)*, 654-666.
- McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a Digital Age: How Educators Use Technology to Improve Student Learning. *Journal of Research on Technology in Education*, 48(3), 194-211. doi:10.1080/15391523.2016.1175856

- Meredith, G. D., Walter, R. B., & Joyce, P. (2007). *Educational research: An introduction*. Boston: Pearson.
- Mfaume, H. (2019). Awareness and use of a mobile phone as a potential pedagogical tool among secondary school teachers in Tanzania. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 154-170.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook (2nd ed.)*. Thousand Oaks, California: Sage.
- Miles, M., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A Methods sourcebook (3rd ed.)*. Los Angeles: Sage publications.
- Miller, M. (2007). *A Mixed method study to identify aspects of Technology leadership in elementary schools. PhD thesis*. Virginia: Regent University.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record.*, 108(6), 1017-1054. Retrieved May 2019, from http://one2oneheights.pbworks.com/f/MISHRA_PUNYA.pdf
- MoES. (2008). *Revised Education Sector Strategic Plan 2007-2015*. Kampala: Ministry of Education and Sports.
- Morse, J. M. (1995). The significance of saturation. *Qualitative Health Research*, 5, 147–149. doi:10.1177/10497323950050
- MTN. (2016). *Integrated report for the year ended 31 December 2016*. Kampala: MTN Group Limited.
- Muhtadi, D., Wahyudin, Kartasasmita, B., & Prahmana, R. (2017). The integration of technology in teaching mathematics. *Journal of Physics: Conf. Series 943 (2017) 012020*, 1-8. doi:10.1088/1742-6596/943/1/012020
- Mutonyi, H., & Norton, B. (2007). ICT on the margins: lessons for Ugandan education. . *Language and Education*, 21(3), 264-270.
- Mwawasi, F. (2014). Technology Leadership and ICT Use: Strategies for Capacity Building for ICT Integration. *Journal of Learning for Development*. Retrieved from <http://www.jl4d.org/index.php/ejl4d/article/view/24/31>
- Myers, M. (1997). *In Information Systems: An Emerging Discipline?*. London : McGraw-Hill.
- Nakabugo, M. G., Opolot-Okurut, C., Ssebbunga, C. M., Maani, J. S., & Byamugisha, A. (2008). Large Class Teaching in Resource-Constrained Contexts: Lessons from Reflective

- Research in Ugandan Primary Schools. *Journal of International Cooperation in Education*, Vol.11 No.3 , 85-102.
- Nakazibwe, V. (2011). *An Assessment of the status of Arts Education in Uganda*. Kampala: UNESCO.
- Nakintu, R., & Neema-Abooki, P. (2015). Usability of computers in teaching and learning at tertiary institutions in Uganda. *African Journal of Teacher Education*., 4(1).
- Ng, W. K., Miao, F., & Lee, M. (2009). *Capacity-building for ICT integration in education (Review)*. Retrieved from http://www.eepsea.org/mimap/ev-140839-201-1-DO_TOPIC.html
- Nowell, L., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, 16, 1-13. doi:10.1177/1609406917733847
- O'Connor, H., & Gibson, N. (2003). A Step-by-Step Guide to Qualitative Data Analysis. *Pimatisiwin: A Journal of Aboriginal & Indigenous Community Health*, 1(1), 63-90.
- Oguzor, N. S. (2011). Computer Usage as Instructional Resources for Vocational Training in Nigeria. *Contemporary Educational Technology*, 2(3), 188-199.
- Onwuagboke, B. B., Singh, T. K., & Fook, F. S. (2015). Integrating Technology in Art Education in Nigerian Education System: The Need for an Effective Pedagogical Approach. *Mediterranean Journal of Social Sciences*, 6(4). doi:10.5901/mjss.2015.v6n4s1p184
- Oyenak, I. (2018). *Decentralisation and Multiculturalism in the Sudan/South Sudan: An analysis of the Policy and Practice of Multicultural Education in Selected Public Primary Schools in South Sudan*. University of Oslo, Faculty of Educational Sciences. Oslo: University of Oslo. Retrieved March 20, 2020
- Park, S. H., & Ertmer, P. A. (2008). Examining barriers in technology-enhanced problem-based learning: Using a performance support systems approach. . *British Journal of Educational Technology*, 39(4), 631-643.
- Patton, M. (1990). *Qualitative evaluation and research methods*. Beverly Hills, CA: Sage.
- Patton, M. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Patton, M. Q. (1999). Enhancing the Quality and Credibility of Qualitative Analysis. *Health Services Research*, 34(5), 1189-1208.

- Phelps, R., & Maddison, C. (2008). ICT in the secondary visual arts classroom: A study of teachers' values, attitudes and beliefs. *Australasian Journal of Educational Technology*, 24(1), 1-14. Retrieved May 2019, from <http://www.ascilite.org.au/ajet/ajet24/phelps.html>
- Philliber, S., Schwab, M., & Samsloss, G. (1980). *Social research: Guides to a decision-making process*. Itasca, IL: Peacock.
- Plano, C. V., & Creswell, J. (2008). *Student study guide to accompany educational research: Planning, conducting and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River: Pearson Education.
- Radclyffe-Thomas, N. (2008). White Heat or Blue Screen? Digital Technology in Art & Design Education. *International Journal of Art & Design Education*, 158-167.
- Ragnedda, M., & Muschert, G. W. (2013). *The Digital Divide: The internet and social inequality in international perspective*. New York: Routledge.
- Røkenes, F. (2016). *Doctoral Thesis: Preparing Future Teachers to Teach with ICT: An investigation of digital competence development in ESL student teachers in a Norwegian teacher education program*. Trondheim: Norwegian University of Science and Technology .
- Røkenes, F. M., & Krumsvik, R. J. (2014). Development of student teachers' digital competence in teacher education - A literature review. . *Nordic Journal of Digital Literacy*, 9 (04), 250-280.
- Roland, C. (2010). Preparing Art Teachers to Teach in a New Digital Landscape. *Art Education*, 63: 1, 17-24.
- Sekaran, U. (2003). *Research methods for Business. A Skill building Approach (4th Edition)*. New Jersey: John Wiley & Sons Inc.
- Sentance, S., & Csizmadia, A. (2017). Computing in the curriculum: Challenges and strategies from a teacher's perspective. *Education and Information Technologies*, 22(2), 469–495. doi:<https://doi.org/10.1007/s10639-016-9482-0>
- Shin, R. (2010). Taking digital creativity to the art classroom: Mystery box swap. *Art Education*, 63(2), 38-42.
- Shulman, L. (1987). Knowledge and Teaching: Foundations of the new reform. *Harvard Educational Review*., 57(1), 1-22.
- Shulman, L. S. (1986). Those Who Understand: Knowledge Growth in Teaching. *Educational Researcher*, 15(2), 4-14. Retrieved from <http://www.jstor.org/stable/1175860>

- Silverman, D. (2011). *Interpreting qualitative data: A guide to the principles of qualitative research*. London : SAGE.
- Silverman, D. (2013). *Doing Qualitative Research*. Washington DC: Sage.
- Soomro, S., Soomro, A. B., Ali, N. I., Bhatti, T., Basir, N., & Gill, N. P. (2018). TPACK Adaptation among Faculty Members of Education and ICT Departments in University of Sindh, Pakistan. *International Journal of Advanced Computer Science and Applications (IJACSA)*, 9(5), 203-209. Retrieved from www.ijacsa.thesai.org
- Stewart, J. (2007). Local experts in the domestication of information and communication technologies. *Information, Communication and Society*, 10(4), 547-569. doi:<https://doi.org/10.1080/13691180701560093>
- Tarus, J. K., Gichoya, D., & Muumbo, A. (2015). Challenges of implementing e-learning in Kenya: A case of Kenyan public universities. *International Review of Research in Open and Distributed Learning*, 16(1), 120–141.
- Thomson, P. (2012, 3 3). Beginning the literature review – taking notes [Blog post]. Retrieved from <https://patthomson.net/2012/03/03/doing-your-literature-review-taking-notes/>
- Tobin, G. A., & Begley, C. M. (2004). Methodological rigour within a qualitative framework. *Journal of Advanced Nursing*, 48, 388–396.
- Trainin, G., & Friedrich, L. A. (2014). Technological Pedagogical Content Knowledge in Teacher Preparation: Impact of Coaching Professional Development and Mobile Devices. *American Educational Research Association Annual Conference*. Philadelphia, Pennsylvania : Education and Human Sciences, College of (CEHS). Retrieved from <https://digitalcommons.unl.edu/cehsgpirw/29/>
- Trucano, M. (2016). *Teachers and tablets, mobile devices and 'MOOC Times': Innovations in technology use in education in developing countries. Excerpts from the World Bank's EduTech blog (Volume VII)*. Washington, DC: The World Bank.
- Tulinayo, F., Ssentume, P., & Najjuma, R. (2018). Digital technologies in resource constrained higher institutions of learning: a study on students' acceptance and usability. *International Journal of Educational Technology in Higher Education*, 1-19. Retrieved from <https://doi.org/10.1186/s41239-018-0117-y>
- Tusiime, W., Johannesen, M., & Gudmundsdottir, G. (2019a). Developing teachers' digital competence: approaches for Art and Design teacher educators in Uganda. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 15(1), 133-147. Retrieved from <http://ijedict.dec.uwi.edu/viewarticle.php?id=2556>

- Tusiime, W., Johannesen, M., & Gudmundsdottir, G. (2019b). The Dilemma of Teaching with Digital Technologies in Developing Countries: Experiences of Art and Design Teacher Educators in Uganda. *Nordic Journal of Comparative and International Education (NJCIE)*, 3(2), 55-71. doi:<http://doi.org/10.7577/njcie.3313>
- Uganda. (2014a). *National Information and Communications Technology Policy for Uganda*. Kampala: Ministry of Information and Communications Technology. Retrieved from http://ict.go.ug/wp-content/uploads/2018/11/ICT_Policy_2014.pdf
- Uganda. (2014c). *Enhancing Teacher Education for Bridging the Education Quality Gap in Africa: Needs Assessment Framework of Teacher Training and Development to ensure Education for All (EFA)*. Kampala: Ministry of Education and Sports.
- Uganda. (2015). *ICT Sector Strategic and Investment Plan (2015/16 – 2019/20)*. Kampala: Ministry of Information and Communications Technology. Retrieved from http://npa.go.ug/wp-content/uploads/2018/01/ICT_SIP-2015-16-to-2019-20.pdf
- Uganda. (2014b). *Integrating ICT into Education in Uganda*. Kampala: Uganda Communications Commission (UCC). Retrieved from <https://www.ucc.co.ug/files/downloads/ICT%20Integration%20into%20teaching%20and%20learning%20booklet%202014.pdf>
- UgandaMoES. (2008). *Revised Education Sector Strategic Plan 2007-2015*. . Kampala: Ministry of Education and Sports.
- UgandaMoES. (2016). *Active Teaching & Learning: A focus on principles and practices of learner-centred pedagogy as a teaching approach to achieve quality education*. Entebbe: Uganda Printing and Publishing Cooperation.
- UNESCO. (2005). *Regional Guidelines on Teacher Development for Pedagogy-Technology Intergration*. Bonn: Germany: UNESCO.
- UNESCO. (2008). *ICT Competency Standards for Teachers: Policy Framework*. Bonn: UNESCO. Retrieved from <http://unesdoc.unesco.org/images/0015/001562/156210E.pdf>
- UNESCO. (2015). *Information and Communication Technology in Education in Sub-Saharan Africa: A Comparative Analysis of Basic e-readiness in Schools*. Montreal: UNESCO.
- UNESCO. (2006). *Roadmap to Arts Education*. Bonn: UNESCO.
- Unwin, T. (2005). Towards a framework for the use of ICT in teacher training in Africa. *Open Learning. The Journal of Open and Distance Education*, 20(2).

- Van Deursen, A. J., & Van Dijk, J. A. (2010). Measuring internet skills. *International Journal of Human- Computer Interaction*, 26(10), 891-916.
doi:http://dx.doi.org/10.1080/10447318.2010.496338.
- van Deursen, A., & van Dijk, J. (2009). Using the Internet: Skill related problems in users' online behavior. *Interacting with Computers*, 21, 393–402. Retrieved from www.elsevier.com/locate/intcom
- van Deursen, A., & van Dijk, J. (2015). Toward a Multifaceted Model of Internet Access for Understanding Digital Divides: An Empirical Investigation. *The Information Society*, 31, 379–391. doi:10.1080/01972243.2015.1069770
- van Deursen, A., & van Dijk, J. (2019). The first-level digital divide shifts from inequalities in physical access to inequalities in material access. *New media & society*, 21(2), 354–375. doi:https://doi.org/10.1177/1461444818797082
- van Dijk, J. (2005). *The Deepening Divide: Inequality in the Information Society*. Thousand Oaks: Sage.
- van Dijk, J. (2006). Digital divide research, achievements and shortcomings. *Elsevier*, 34, 221–235. Retrieved from www.elsevier.com/locate/poetic
- van Dijk, J. (2008). *The Digital Divide in Europe: The Handbook of Internet Politics*. New York: Routledge.
- van Dijk, J. (2012). The Evolution of the Digital Divide: The Digital Divide turns to Inequality of Skills and Usage. In B. e. (Eds.), *Digital Enlightenment Yearbook 2012* (pp. 57-75). Amsterdam, Netherlands: IOS Press. doi:10.3233/978-1-61499-057-4-57
- Van Dijk, J. (2017). Digital Divide: Impact of Access. *The International Encyclopedia of Media Effects*, 1-11. doi:doi:10.1002/9781118783764.wbieme0043
- van Dijk, J., & Hacker, K. (2003). The Digital Divide as a Complex and Dynamic Phenomenon. *The Information Society*, 19(4), 315-326. doi:10.1080/01972240309487
- van Laar, E., van Deursen, A., van Dijk, J., & de Haan, J. (2017). The relation between 21st-century skills and digital skills:A systematic literature review. *Computers in Human Behavior*, 72, 577-588.
- Voogt, J., & McKenney, S. (2017). TPACK in teacher education: are we preparing teachers to use technology for early literacy? *Technology, Pedagogy and Education*, 26(1), 69-83. doi:10.1080/1475939X.2016.1174730
- Wamakote, L. (2010). *National government investment in ICT initiatives in primary and secondary schools in East Africa*. East Africa: Centre for Commonwealth Education &

Aga Khan University Institute for Educational Development – Eastern Africa Research Report No. 1.

Wood, J. (2004). Open minds and a sense of adventure: how teachers of art & design approach technology. *International Journal of Art & Design Education*, 23(2), 179–191. Retrieved May 2019, from <https://doi.org/10.1111/j.1476-8070.2004.00396.x>

WorldBank. (2016). *Digital Dividends*. Washington DC: WorldBank.

Yin, R. K. (2014). *Case study research: Design and methods*. (5th ed.). Thousand Oaks, California: Sage.

Appendices

Appendix 1: Article I

Article I

Tusiime, W. E., Johannesen, M., & Guðmundsdóttir, G. (2019). The dilemma of teaching with digital technologies in developing countries: Experiences of art and design teacher educators in Uganda. *Nordic Journal of Comparative and International Education (NJCIE)*, 3(2), 55-71.
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The Dilemma of Teaching with Digital Technologies in Developing Countries: Experiences of Art and Design Teacher Educators in Uganda

Wycliff Edwin Tusiime¹

Ph.D. Candidate, OsloMet - Oslo Metropolitan University, Norway

Monica Johannesen

Professor, OsloMet - Oslo Metropolitan University, Norway

Greta Björk Gudmundsdottir

Associate Professor, University of Oslo, Norway

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Abstract

This case study explores how teacher educators use digital technologies in teaching Art and Design (A&D) in a developing country. It uses semi-structured interviews and non-participant observations to gather qualitative data from teacher educators at two teacher training institutions in central Uganda. To understand the actual use of technologies by teacher educators in the A&D classroom, analysis of the data employed concepts from van Dijk's resources and appropriation theory (RAT) and Mishra and Koehler's TPACK framework. The findings indicate that low digital competence among teacher educators and insufficient access to appropriate hardware, software and the Internet means that A&D teacher educators in Uganda only occasionally use digital technologies in the classroom. Instead, teacher educators use non-professional software such as Microsoft Office to teach Art and Design subjects. The findings further confirm teacher educators' limited awareness of the relationship between technology, pedagogy and content knowledge in the Art and Design classroom. Insufficient access to adequate digital resources, skills and knowledge explains the low creative use of digital technologies in teaching A&D lessons.

Keywords: digital technology; art and design; teacher education

Introduction

Amid the growing impetus to embrace digital technology, there is evidence of substantial adoption of technology for pedagogical purposes in different fields of teacher education worldwide (Salavat, 2016; Lin, 2011; Kotrlik & Redmann, 2009; UNESCO, 2002). Eady and Lockyer (2013) argue that technological advances in recent years have increased the

¹ Corresponding author: wycliffdux@yahoo.com

variety and accessibility of digital tools, expanding teachers' opportunities to use these in the classroom. Eady and Lockyer (2013) note that many teachers can now use digital multimedia technologies combining text, image, video and audio to improve lesson design, to present information, and to more effectively engage and motivate students. In Art and Design (A&D) teacher education, Lemon (2015) suggests that digital technologies expand teaching and learning possibilities by supporting shared visions, innovative art practices and high levels of engagement in meaning making. Through exposure to these new technologies, art educators can stimulate student learning, imagination and creativity (Black & Browning, 2011) and students can learn how to apply their digital knowledge and skills for creative purposes (Freire & McCarthy, 2014). For example, A&D educators can use a range of software applications to help learners to develop and edit three-dimensional (3D) images and films (Örtegren, 2012).

In developing countries, as elsewhere, Internet access and digital technologies have changed pedagogy and student participation in Art and Design education (Appiah & Cronjé, 2012; Kampouropoulou, Athanasiadis, & Stefos, 2011). For example, Bolujide (2016) reports the use of multimedia software by visual art educators in Nigeria to provide challenging and authentic content that develops the student's mind through exploration, discovery and creativity. Appiah and Cronjé (2012) note that computer technologies in developing countries are slowly changing A&D pedagogy, as both educators and students spend part of teaching-learning time using computers or other digital devices in the design process. With greater access to digital technologies globally, educators can build students' capacity to present, research, process and communicate their art (Lemon, 2015).

However, while teacher educators' schools and classrooms in affluent industrialized nations have abundant technological resources (Vrasidas & McIsaac, 2011; Delacruz, 2004), educators in many parts of the developing world have limited access to such learning aids (Bolujide, 2016; Onwuagboke, Singh, & Fook, 2015; Appiah & Cronjé, 2012). The gap between those who do and do not have access to digital technologies (the digital divide) has for many years been recognized as a multidimensional phenomenon affecting the integration of digital technologies in work processes around the globe (Fuchs & Horak, 2008). Fuchs and Horak indicate that users in the least developed African countries, with low incomes, education, and skills, have very low access to digital technologies and low usage rates compared to users in developed countries. In Turkey, Acilar's (2011) research indicates that although computer and Internet use has significantly increased over time, there is still a digital divide in computer and Internet use within the country, and between Turkey and developed countries. Acilar (2011) notes a significant and consistent gap in computer and Internet use within Turkey; between rural and urban residents, the young and the elderly, male and female, and higher and lower levels of education. Additionally, a significant number of educators make insufficient use of the available technology (Black & Browning, 2011; Peeraer & van Petegem, 2010; Phelps & Graham, 2008). Similarly, studies since the turn of the millennium (Gilakjani, Leong, & Ismail,

2013; Brinkerhoff, 2006; Wood, 2004; Delacruz, 2004) indicate that the use of technology in the classroom presents a dilemma for a majority of educators because of inadequate digital resources, lack of appropriate training, lack of time, lack of institutional support and negative attitudes. In addition, Mishra and Koehler (2006) note a tendency to introduce technology into the educational process without due regard to how it is used, and this compromises its effective pedagogical use.

With regard to A&D education, Wood (2004) identifies a need for art-specific technological training and digital resources for teacher educators. This is because technology is redefining A&D itself in terms of themes, tools and vocabulary beyond how it is taught or learned and so A&D educators need to embrace technology to accommodate changes in teaching practice. However, Apau (2017) notes that even when teachers in developing countries like Ghana use these technologies, it is often for supplementary purposes such as producing lesson materials and preparing content. Apau (2017) suggests that, in addition to both content and pedagogical knowledge, contemporary teaching practice also requires technological knowledge; this includes the teacher's ability to use new technologies for learning purposes, both inside and outside the classroom.

Clearly, then, despite the increasing adoption of digital technologies in the classroom since the turn of the century, educators have not fully exploited them for pedagogical purposes, especially in teacher education programmes in areas such as A&D. Developing countries face particular challenges in this regard. In Uganda, for instance, although the National ICT Policy for education (Uganda, 2014) sets a framework of curriculum and teacher training that facilitates and guides the development and integration of digital technology in all aspects of education, the extent to which digital technologies are used in teacher education programmes such as A&D is unknown (Luwangula, 2011). Andema, Kendrick, & Norton's (2013) case study findings indicate that, despite the existing ICT policy and teacher educators' enthusiasm for digital technology, digital literacy in Uganda is still hampered by the expense of Internet connectivity, inadequate training, power outages, and culturally irrelevant curricula. As such, the digital competences gained by educators through formal teacher education in Uganda are overly generic and not specific to the teaching of teacher education subjects such as Art and Design (Tusiime, Johannesen, & Gudmundsdottir, 2019).

In order to explore how A&D teacher educators use digital technologies in Uganda's teacher training institutions (TTIs), the present study was guided by the following research question.

How do Ugandan teacher educators (TEs) use digital technology in teaching art and design (A&D)?

Theoretical points of departure

This study drew on van Dijk's (2005) resources and appropriation theory (RAT) and Mishra and Koehler's (2006) TPACK framework to analyse the use of technology among A&D teacher educators. RAT has previously been used to describe the digital divide in terms of the relationships between four elements: categorical inequalities, resource distribution, access to ICTs, and participation in society (van Dijk, 2017). RAT is particularly useful for investigating the use of digital technology in the context of limited resources in a developing country.

According to van Dijk, four successive kinds of interdependent access are needed to appropriate new technology:

motivational access (motivation to use digital technology), physical or material access (possession of computers and Internet connections or permission to use them and their contents), skills access (possession of digital skills: operational, informational and strategic skills) and usage access (number and diversity of applications, usage time). (2005, p. 21)

Usage access helps to clarify how people use digital technologies for a particular purpose. Usage relates to properties of the hardware, software or content that can either support or impede access. As a dependent factor, van Dijk (2005) argues that usage access can be analysed in terms of *actual use*, *usage time or frequency*, *usage diversity*, *broadband use and creative use*. As van Dijk relates actual use to physical access to computers and the Internet, the present study explores TEs' physical access to digital technologies when teaching A&D; this broadly includes hardware, software and the Internet. Secondly, we relate usage time to how often TEs use digital technologies like hardware, software and the Internet when teaching A&D. Thirdly, we relate usage diversity to how TEs use digital technologies in teaching A&D. Fourthly, broadband use refers to Internet strength and access and how it supports the use of new applications and online users (for example, teacher educators) at a given time. For present purposes, the term *Internet* is used to refer to broadband access and encompasses physical access as well as usage diversity. Finally, creative use refers to how users themselves create digital content such as websites, blogs or videos or post contributions to an online bulletin board, news group or community (van Dijk, 2005).

In relation to van Dijk's concept of *creative use*, we argue that it is also important to understand the particular way in which TEs use technology creatively for educational purposes. That means how TEs apply knowledge that emerges from the dynamic interplay of knowledge domains when teaching with digital technologies. This can be understood and explained by reference to Mishra and Koehler's (2006) technological, pedagogical and content knowledge framework (TPACK) (Figure 1).

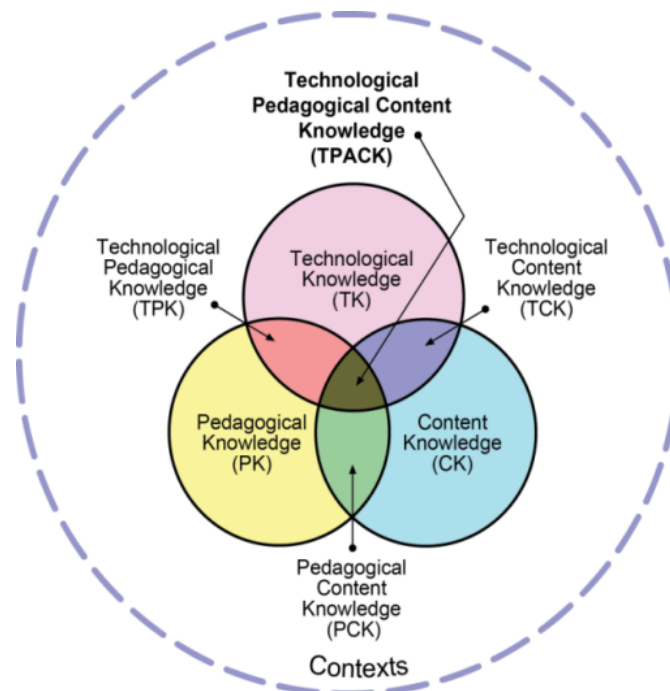


Figure 1: TPACK Framework (Mishra & Koehler, 2006)

Figure 1 shows how compound competences emerge from the three intersections between technology, pedagogy and content. In the present context, technological-pedagogical knowledge might refer, for example, to knowing how to use multimedia to engage students in learning; pedagogical-content knowledge might refer to knowing how to engage students in subject-area knowledge creation; and technological-content knowledge might refer to knowing how to use Adobe Illustrator software to demonstrate illumination effects. The complex compound knowledge required by teachers falls within the intersection of all three areas. Known as technological pedagogical content knowledge (TPACK), this might, for example, address how a teacher educator uses Adobe Illustrator software to engage students in concretizing their knowledge of illumination techniques when evaluating images. Although the TPACK framework has been criticised for a lack of empirical support and scientific usefulness (Archambault & Barnett, 2010; Archambault & Crippen, 2009), Koehler et al. (2011) contend that teachers can make creative use of TPACK to rethink and reimagine what they teach (content knowledge) and how they teach (pedagogical knowledge), and to critique and understand how they can adapt, reuse and repurpose new technology for use in the classroom (technology knowledge) to become thoughtful practitioners (Mishra & Koehler, 2006).

Therefore, to analyse TEs' use of digital technologies to teach A&D in Uganda, we largely relied on van Dijk's theoretical concepts of access to digital technologies (including access to the Internet), usage frequency and usage diversity (including internet-based resources) and creative use. In addition, the TPACK framework was employed as a tool in the analysis to understand TEs creative use of digital technologies in teaching A&D. The TPACK framework has a specific focus on how teachers teach with technologies.

This construct highlights the complex interplay of technology, pedagogy and content, unlike van Dijk's RAT, which focuses on a more general use of digital technologies. Van Dijk (2005) posits that the different kinds of access in RAT are cumulative; i.e. they may depend on each other. It is therefore important to note that the core concepts for analysis in the paper were inspired by van Dijk's RAT, with a particular focus on usage access. Other forms of access that include physical or material and skills access formed an additional backdrop for analysis and discussion.

Methods

The aim of this study was to understand how TEs from two teacher training institutions (TTIs) in central Uganda use digital technology when teaching A&D. A case study design (Yin, 2014) was selected as optimal for in-depth description of a case or multiple cases (Creswell, 2007). This approach provided rich data for a deeper understanding (Denzin & Lincoln, 2005) of the phenomena under investigation.

Purposive sampling was favoured because it provides for the appropriate selection of participants. This yields insights into the problem under investigation rather than empirical generalizations (Patton, 2002; Miles & Huberman, 1994). Here, the target group was ten A&D teacher educators from two TTIs in Uganda, who were chosen for their acumen and understanding of the phenomenon under investigation. It should be made clear that all participants were qualified individuals who instruct prospective and practising A&D teachers at different levels of professional development.

Data were collected by means of semi-structured interviews and non-participant observations. Kvale (1996) has argued that this combination of interviews and observations is likely to provide more valid information. Interviews offer a useful way of exploring the views, experiences, beliefs and motivations of individual participants (Hardman, 2005; Barriball & White, 1994) regarding the target phenomena and provide reliable and comparable data (Gill et al., 2008). Interviews with the individual participants were conducted at convenient intervals and lasted an average of one hour. This allowed sufficient time to explore the deeper meaning of participants' views before a saturation point (diminishing returns or no new data) was reached (Glenna, 2008).

Kawulich (2005) has suggested that observation-based methods enable researchers to assess nonverbal expressions of feeling, to see how participants interact among themselves and with other objects, and to check how much time is spent on various activities. To this end, from a total of ten TEs who had been previously interviewed, four TEs (two at each institution) were observed in classroom practice – this observation was guided by the TPACK observation checklist. Each observation took an average of one hour in the classroom during which field notes were taken. The observation checklist is a tool for assessing teachers' use of their technology, pedagogy and content knowledge in classroom practice (Trainin & Friedrich, 2014). In this study, the TPACK observation checklist focused on a number of items: firstly, the composition of the classroom (for example,

students, classroom environment); secondly, the TPACK question (for example, how TEs observed the relationship between different components i.e. TK, CK, PK, TCK, TPK, PCK and TPCK); thirdly, teaching learning activities (for example, pedagogical approaches and students' participation); and fourthly, the evidence of TPACK in the lesson plan.

All the interviews were audio-recorded and transcribed, along with field notes from the observations. It is important to note that all the data was collected and transcribed by the first author. Although qualitative methods such as interviews and observation can yield rich and informative data, they are often criticised for their subjectivity (Wood & Griffiths, 2007), and this may compromise validity and reliability. To avoid subjectivity, interview data were cross-referenced with the observations to check for any inconsistencies. In addition, for triangulation purposes and to ensure the quality of the study findings, data from the observations were subsequently used to supplement the interview findings. Furthermore, for ethical reasons, research clearance was sought and granted by Mildmay Uganda Research Ethics Committee (MUREC), the Uganda National Council for Science and Technology (UNCST), the Norwegian Centre for Research Data (NSD), and the participating institutions.

Based on the main research question and transcribed data (interviews and observation notes) from ten TEs, the authors performed a first-level analysis that identified frequently occurring words and phrases in the data (Burnard, Gill, Stewart, Treasure, & Chadwick, 2008). These were colour-coded, and similar codes were later clustered to define empirical categories. A second-level analysis was performed using the theoretical concepts access to digital technologies, usage frequency, usage diversity and creative use described in the previous section to select the data presented in this paper. To protect the identity of institutions and participants, pseudonyms (Kabwohe and Sheema) and codes (TE#1, TE#2...) were used in all transcripts and in the presentation of findings in the next section.

Findings and Discussion

The main research question asked was “How do Ugandan TEs use digital technology when teaching Art and Design?”. The findings are described and discussed in terms of the theoretical concepts referred to earlier: *physical access to digital technologies*, *usage frequency*, *usage diversity*, and *creative use*.

Access to digital technologies

To begin, each TE was interviewed about the kinds of digital technologies available to them when teaching A&D, and how those technologies were accessed in TTIs. All of the TEs reported that the available digital technologies (hardware, software and Internet) were insufficient and not easily accessible for teaching use. One TE described the situation as follows:

...we do not have enough digital resources at this institution. Each of our classes has over 60 students. In this room, there are 15 computers, and the other room has 20. Having so many students on one computer limits individual students' access, and some will just be onlookers, doze off or distract others. [...] We want something to be done, but we are limited by the resources. (TE#3)

Remarkably, all of the TEs indicated that there was no open access to the Internet in any of the classes, computer labs, staff rooms or other locations within their institution. Several TEs reported the inadequacy of both hardware and software technologies for teaching A&D classes. For that reason, a few TEs reported having purchased or used personal digital tools, and others mentioned access in public places like Internet cafes or through colleagues who owned such tools. According to one TE,

...I am not in a position to make full use of online platforms because the Internet is not easily accessible at the department where I work. In most cases, I use the Internet on my phone, buying limited data bundles for myself. It is very expensive to commit money to this, especially with social media tax [...] nor do we have enough hardware tools at the institution... (TE#4)

The above accounts confirm what was observed in the classrooms at both institutions. During the observations, it was noted that even among the available digital resources, some were not working (e.g. cameras and computers in the computer labs at both TTIs). At both institutions, it was also observed that professional A&D software applications were not installed. Although a few TEs had personal laptop computers and smartphones, the majority did not own any of the essential digital tools for teaching A&D.

According to van Dijk (2005), physical access to digital technologies is a necessary but not always sufficient condition for technology use. In the present case, usage of digital technologies for teaching A&D at Ugandan TTIs was seen to be impeded by TEs' and students' limited access. In addition, the Sheema findings indicated that the institutional policies (rules and regulations) prohibited students from bringing mobile phones into the institution, although a number of TEs reported using mobile phones during teaching. This invites questions about how effective teaching with digital technologies could be if such rules and regulations prevent students from having personal mobile phones, computers or other devices. Delacruz (2004) notes that teachers' utilization of technology in the classroom is largely a result of institutional policies and support mechanisms that govern students and teachers' personal and professional interest in and access to those technologies. It follows that teachers in Ugandan TTIs may find it difficult to teach with digital technologies because of unsupportive institutional policies. Such policies sometimes contradict the aims of the national ICT policy for education (Uganda, 2014) that guides the development and integration of digital technologies in teacher education programmes. In this regard, Delacruz (2004) suggests the need for supportive institutional policies and procedures to ensure teachers' successful utilization of new digital technologies in such institutions. In the Ugandan context, there is a need for further research to highlight the contradictions between national and institutional ICT policies for education and the actual use of digital technologies in teaching teacher education programmes such as Art and Design.

Usage frequency

When TEs were interviewed about how often they used digital tools in teaching A&D, several reported occasional use, as indicated in the following statement:

I cannot lie about that. Sometimes I use [digital tools], maybe once a month because of the constraints, mostly for online tools. For hardware tools like computers and projectors, it might be two or three times a week. If we had more computers, usage would be on a daily basis... (TE#3)

On the other hand, some TEs reported using digital technologies regularly when teaching A&D. One had this to say:

For me, almost every time I go to class, I always use some digital tools. [...] I find it necessary to use these [digital tools], whether the class is very big and requires use of a projector, or whether it is small and students can gather around a laptop or desktop computer. [...] I also regularly use digital images for reference in my classes to enable students to understand what I'm teaching in A&D. (TE#7)

In the interviews, only one TE admitted to having rarely used digital technologies in teaching A&D because of limited digital competence and inadequate access to digital resources. Although some TEs reported using digital technologies regularly, the first author observed in classroom observations at both TTIs that the use of digital technologies was treated as an add-on or supplement to the curriculum, rather than as an integral part of the subjects taught. At one TTI, minimal time was allocated to computer studies, and TEs reported that the subject was never assessed, either by the institution or the national examination body, because it was simply an add-on to the teaching curriculum. Additionally, the lack of adequate digital resources reported by TEs at both TTIs, and confirmed during observations, limited the use of digital technologies in the A&D classroom.

Phelps and Maddison (2008) have previously cited time as a major constraint on teachers' integration of digital technologies in the classroom. However, teachers require sufficient time if they are to improve digital competences. The authors noted that teachers who were allowed time to develop their digital skills could be more creative than those who had insufficient time. Van Dijk (2005) posits that precise usage time is a more valid indicator of digital media usage than respondents' reports that they use these media at some time or place. However, van Dijk also acknowledges that the required time diary data are not usually available, and that usage may also be determined by other factors like access, digital skills and user motivation level. Although this study did not collect data on actual daily usage time, the findings from interviews and observations clearly indicate low usage of digital technologies among TEs in Ugandan TTIs.

Usage diversity

Data from the interviews and observations clearly indicate some diversity in the use of digital technologies in the teaching of A&D. For instance, all TEs interviewed at both

TTIs report using the Internet to search and download information related to their teaching for later use in lesson planning. Despite limited Internet access, all of the TEs indicated that the Internet provides broader scope and more up-to-date information on A&D subjects than the traditional physical art books available from the institutions' libraries or bookstores. In this regard, one TE made the following comment:

In my situation, especially now that I teach art history at undergraduate level, I rely on the Internet as a source of information but also as a vehicle for communicating to my learners what I have decided to deal with at a specific point in the course unit... (TE#5)

Similarly, another TE said:

... as a teacher, I can acquire teaching resources such as videos in the field of A&D with the help of digital tools. For instance, having realized that YouTube is a very good tool for teaching, [...] I download videos related to the project that I want to share with students ... and because such videos cannot be accessed online without the Internet, I save them on a CD for later use in the classroom—even without the Internet, [I can play them] from a DVD player or a computer with a projector... (TE#3)

These examples illustrate that although A&D TEs at both institutions are hindered by limited or non-access to digital resources like the Internet, they try to make use of online services and platforms in the teaching process. Some TEs reported having Internet access on personal devices like smartphones, which they could use to search for information they needed to prepare teaching materials for use in the classroom. Based on the observations at both institutions, TEs lacked Internet access in classrooms or computer labs and could not use Internet resources for actual teaching. However, in one of the observations a TE was seen to browse the Internet on a personal smartphone to show fashion images to students in a textile design class. The phone was passed around the classroom to allow students to see what the educator had just explained. In other cases, TEs referred to important websites or links, enabling students to search on their own after the lesson.

The current findings align with Burton (2001, as cited in Delacruz, 2004) who concludes that most art educators in the United States report using electronic technologies to make handouts and to assess/grade students while others report using computers for online research when preparing lessons. Van Dijk (2005) posits that people with greater Internet access (bandwidth) take fuller advantage of the opportunities afforded by new media. He adds that people not only save waiting time but can also use a large number of online applications. Based on our own empirical findings, we argue that unreliable access to the Internet and other hardware and software limits TEs' appropriation of such technologies in the A&D classroom.

In addition, several TEs reported having used certain hardware and software in preparing digital content for use in teaching A&D. For instance, all of the TEs mentioned having used Microsoft Office applications like Word and PowerPoint to prepare basic teaching materials for A&D, including notes, schemes of work, lesson plans and presentations. These were sometimes printed out and distributed to students as handouts or used as classroom teaching aids. In this regard, some TEs reported having used digital cameras

or smartphones to take photographs or record videos that they would later integrate to provide inspiration in their A&D teaching, using appropriate computer software. Only a few TEs mentioned having created multimedia content using relevant design software, as in the following:

... I have used After Effects in making videos and some tutorials to aid my teaching. So, I use Adobe Creative Suite to create teaching content [...] Of course, I also sometimes use Microsoft Word to prepare short training manuals or notes for students, and PowerPoint to create presentations... (TE#4)

These findings confirm something also noted during the classroom observations—that although TEs strove to integrate digital technologies at different levels of A&D teaching, there was a general lack of specialized software at both institutions for teaching A&D subjects. In the labs, the available computers mainly offered basic Microsoft Office applications that were of little use to teachers or students for A&D purposes. At Kabwohe, for instance, at the time this study was conducted, less than ten of the twenty computers in the lab were running fully functional Adobe Create Suite software, which TEs mentioned as having sometimes used in teaching A&D subjects like graphics, textiles and computer-aided design. However, all of the functioning computers at this institution had Microsoft Office. At Sheema, none of the interviewed TEs reported (or were observed) using any of the professional A&D software applications in the classroom. Although a few were competent users of professional software like Adobe Creative Suite, we realized that a majority tended to use the basic Microsoft Office applications, which were readily accessible. This aligns with findings cited in Delacruz (2004) suggesting that, although many art teachers use ICT resources, most use only basic applications (e.g. word processing) rather than those designed to support creativity.

Van Dijk (2005) advises that usage diversity could be understood in different usage contexts; for this reason, although TEs do use digital tools in diverse ways, the digital media they use need to be relevant and appropriate for teaching A&D. Similarly, Wood (2004) notes the need for art-specific digital resources and technological training for teacher educators.

Some TEs at both TTIs reported having used digital technologies to communicate with students about learning activities, to give feedback on assignments, to consult with students and to follow up their learning outside the classroom. One of the TEs described this in the following way:

Sometimes I use tools like the mobile phone and email to communicate to students in preparation for the next classes. I often use phone calls and SMS to communicate with students. (TE#6)

Similarly, TE#8 reported having used WhatsApp to communicate with students. The students sent the TE pictures of their artwork, enabling him to provide online feedback after they had returned home. Several TEs also reported using computer hardware and software

to record and submit students' results or grades and to store progress reports as part of their evaluation. As one TE said:

...I use my computer and basic Office software applications to record students' results. Now, we can also enter students' results in an online e-system at the institution that converts the data to overall grades. However, the system is not effective because of unreliable Internet and system breakdowns... (TE#7)

Based on the above data, it is interesting to note that TEs used their personal digital devices (such as mobile phones) to communicate with students, highlighting the absence of (or at least limited access to) digital technologies at TTIs in Uganda. Additionally, as mentioned earlier, some students did not possess personal digital tools like computers or smartphones, and the few available computers in the labs were not connected to a reliable or accessible Internet. This means that although TEs reported having used personal technologies to send SMS or email to students, students who had no access to mobile phones or other technologies were unlikely to receive or respond to such information.

Van Dijk (2005) argues that issues of digital inequality impede usage access, especially for those with limited access to digital resources and skills, as confirmed by the present findings. Although van Dijk supports the use of mobile phones for sending messages and chatting, he maintains that there must be sufficient access to such resources and the requisite skills and motivation to use them. In the present case, although TEs were motivated to use the few available technological resources, several educators lacked the relevant digital skills for teaching in the A&D classroom.

Creative use

To understand the creative use of digital technologies in the classroom, TEs' self-reports on their own practice were supplemented by observations of classroom teaching at both TTIs. Together, the two data sets help to clarify how TEs found limited creative ways (basic use) of integrating technology, pedagogy and content knowledge (TPACK) in their teaching practice.

The interview data confirm several TEs' basic knowledge of technology for teaching purposes; some even practised this in the classroom, though less creativity. The interviewed TEs at both TTIs reported using digital tools either to simplify A&D procedures and concepts when teaching in the classroom. Specifically, some TEs used various hardware and software during the teaching process to create two-dimensional (2D) or three-dimensional (3D) designs or models. For instance, the following is an account of how one TE used digital tools to simplify the work process in a fabric decoration class:

...digital tools have made the design process easier. For example, in the past, my fabric decoration students used to draw motifs on paper by hand. They would then trace the motif to duplicate copies, but nowadays I can use the computer and Adobe Illustrator software to guide students to draw one segment of the motif, and then copy and paste for a sheet full of motifs in no time. This makes the workflow faster and more convenient for both teachers and students... (TE#4)

In a similar vein, one of the few TEs who reported occasionally using various 2D or 3D design applications in teaching said the following:

... Sometimes, I have used video tutorials from YouTube to teach a computer-aided design class. The students are motivated and interactive and become more creative when they discover the new techniques used by expert designers in the videos to handle design challenges. I have also used 3D software to demonstrate basic concepts like character development in game design, 3D modelling and animation... (TE#1)

These examples are a reminder that TEs seem able to realize teaching goals faster and more easily when using technology than would be possible using traditional teaching techniques. Despite the inadequate access to digital resources referred to above, some TEs who possessed both digital skills and personal resources like computers, phones and design software often had a better chance of engaging students in A&D critiques and artistic projects to develop their creativity. In this regard, Eady and Lockyer (2013) note that using appropriate technologies to create artefacts and products allows educators and students to demonstrate creative thinking and knowledge construction. Van Dijk (2005) also feels that users with relevant digital skills could use digital resources to achieve particular goals in different career contexts ranging from education to business. In the same way, teacher educators and students can apply knowledge constructed using technology to generate new ideas and create expressive products.

In the present context, observations indicated that TEs showed no evidence of the unified knowledge needed to appropriately combine subject content, technology and a pedagogical approach. Instead, several TEs exhibited moderate knowledge of how to use the technologies available to them (TK) and the content they taught (CK), with limited knowledge of approaches used (PK). Overall, the classroom observations at both TTIs suggested that TEs lacked any documented lesson plans for the content they taught or the approaches they used or planned to use. For instance, in one of the computer-aided textile classroom observations, the educator had a laptop, projector and Adobe Illustrator software (technologies) and exhibited moderate digital competence in demonstrating how to design layouts and patterns for a shirt. However, the educator was unable to convey to the students the process used to reach the learning goal. The teaching approach (pedagogy) used in this activity was unclear, and no prior written guidelines (content) were given to students. Consequently, none of the students could apply what the educator had demonstrated when given a classroom assignment.

In all of the classroom observations, TEs failed to demonstrate any evidence of applying the combined technology, pedagogy and content knowledge specified by the TPACK framework for achieving learning outcomes through technology-assisted teaching. In this situation, TEs showed insufficient knowledge of how technology might influence their subject matter and their choice of teaching methods.

During the observations, it was also noted that TEs could not easily explain to students how specific technologies could be used to present or alter teaching content. In many cases, TEs used non-professional A&D software applications like PowerPoint and Word

to teach A&D concepts, making it difficult to explain concepts clearly or to achieve learning goals. These findings align with those of Mishra and Koehler (2006), who note a tendency to introduce technology into the educational process without considering how it is to be used. Teaching creatively with the aid of technology requires teacher educators to synthesize their knowledge of technology, pedagogy and content and to apply it to the design of learning experiences (Koehler, Mishra, Akcaoglu, & Rosenberg, 2013).

Implications and Conclusion

The aim of this study was to develop an in-depth understanding of how Ugandan teacher educators use digital technology when teaching Art and Design. The findings indicate that TEs at TTIs in Uganda only occasionally use digital technologies to teach A&D. This may be partly attributed to a lack of digital competence and insufficient access to digital resources (hardware, software and the Internet). Instead, TEs use non-professional software like Microsoft Office to teach A&D subjects and employ personal digital devices such as mobile phones to access the Internet and communicate with students. The findings suggest that desired learning outcomes mediated by the use of digital technologies may be greatly impeded, and that TEs face an ongoing dilemma in teaching without proper access to digital technologies. In order to increase diverse usage of digital technologies in A&D classrooms, there is a need to address the digital divide that currently exists due to insufficient access to digital technologies and digital skills in Ugandan TTIs. This could be done through a renewed policy focus at both institutional and national levels.

Additionally, the findings highlight TEs' limited awareness of TPACK—the relationship between knowledge of technology (digital tools in use), pedagogy (methods of teaching and learning) and content (taught subject) when teaching in the A&D classroom. The lack of TPACK among TEs explains the limited creative use of digital technologies in teaching A&D in TTIs in Uganda. The implication of this finding is that we need to carry out further research to see whether developing A&D TEs' TPACK competence can improve the creative use of digital technologies in A&D classrooms. Such studies could also address the question of how A&D teacher educators in developing countries can cope when teaching with inadequate access to digital technologies, as identified in this study.

References

- Acilar, A. (2011). Exploring the Aspects of Digital Divide in a Developing Country. *Issues in Informing Science and Information Technology*, 8, 231-244. Retrieved May 2019, from <http://iisit.org/Vol8/IISITv8p231-244Acilar248.pdf> <https://doi.org/10.28945/1415>
- Andema, S., Kendrick, M., & Norton, B. (2013). Digital literacy in Ugandan teacher education: Insights from a case study. *Reading & Writing*, 4(1), 1-8. Retrieved May 2019, from <https://doi.org/10.4102/rw.v4i1.27>
- Apau, S. K. (2017). Technological Pedagogical Content Knowledge Preparedness of Student-Teachers of the Department of Arts and Social Sciences Education of University of Cape Coast. *Journal of Education and Practice*, 8(10), 167-181. Retrieved May 2019, from <https://files.eric.ed.gov/fulltext/EJ1139820.pdf>

- Appiah, E., & Cronjé, J. C. (2012). Thumbnail sketches on idea development: The drawing board vs computer generation. *Art, Design & Communication in Higher Education*, 11(1), 49–61. https://doi.org/10.1386/adch.11.1.49_1
- Archambault, L., & Barnett, J. (2010). Revisiting pedagogical content knowledge: Exploring the TPACK framework. *Computers & Education*, 55(4), 1656–1662. Retrieved May 2019, from <https://doi.org/10.1016/j.compedu.2010.07.009>
- Archambault, L., & Crippen, K. (2009). Examining TPACK among K-12 Online Distance Educators in the United States. *Contemporary Issues in Technology and Teacher Education*, 9, 71-88. Retrieved May 2019, from <https://www.citejournal.org/volume-9/issue-1-09/general/examining-tpack-among-k-12-online-distance-educators-in-the-united-states/>
- Barriball, K., & White, A. (1994). Collecting data using a semi-structured interview: a discussion paper. *Journal of Advanced Nursing*, 19, 328-335. Retrieved May 2019, from <https://doi.org/10.1111/j.1365-2648.1994.tb01088.x>
- Black, J., & Browning, K. (2011). Creativity in Digital Art Education Teaching Practices. *Art Education*, 19-34. Retrieved May 2019, from <https://doi.org/10.1080/00043125.2011.11519140>
- Bolujide, O. G. (2016). Preponderance of ICT in Fine Art (Visual Art) Teaching and Learning in Nigeria. *European Journal of Computer Science and Information Technology*, 4(3), 1-15. Retrieved May 2019, from <http://www.eajournals.org/wp-content/uploads/Preponderance-of-ICT-in-Fine-Art-Visual-Art-Teaching-And-Learning-In-Nigeria.1.pdf>
- Brinkerhoff, J. (2006). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration and beliefs. *Journal of Research on Technology in Education*, 39(1), 22-43. Retrieved May 2019, from <https://files.eric.ed.gov/fulltext/EJ768867.pdf> <https://doi.org/10.1080/15391523.2006.10782471>
- Burnard, P., Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Analysing and presenting qualitative data. *British Dental Journal*, 204(8), 429-432. <https://doi.org/10.1038/sj.bdj.2008.292>
- Creswell, J. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage.
- Delacruz, E. (2004). Teachers' working conditions and the unmet promise of technology. *Studies in Art Education: A Journal of Issues and Research*, 46(1), 6-19. Retrieved May 2019, from <https://doi.org/10.1080/00393541.2004.11650065>
- Denzin, N. K., & Lincoln, Y. S. (2005). *The Sage handbook of qualitative research*. (3rd ed.). London, New Delhi: Sage Publications.
- Eady, M. J., & Lockyer, L. (2013). *Tools for learning: technology and teaching strategies', Learning to Teach in the Primary School*. Australia: Queensland University of Technology. Retrieved May 2019, from <https://ro.uow.edu.au/cgi/viewcontent.cgi?article=1413&context=asdpapers>
- Freire, M., & McCarthy, E. (2014). Four approaches to new media art education. *Art Education*, 67(2), 28-31. Retrieved May 2019, from <https://www.tandfonline.com/doi/abs/10.1080/00043125.2014.11519262>
- Fuchs, C., & Horak, E. (2008). Africa and the digital divide. *Telematics and Informatics*, 25, 99–116. Retrieved May 2019, from http://gunkelweb.com/coms647/texts/digital_divide_africa.pdf <https://doi.org/10.1016/j.tele.2006.06.004>
- Gilakjani, A. P., Leong, L. M., & Ismail, H. N. (2013). Teachers' Use of Technology and Constructivism. *International Journal of Modern Education and Computer Science*, 4, 49-63. <https://doi.org/10.5815/ijmeecs.2013.04.07>
- Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal*, 204(6), 291-295. <https://doi.org/10.1038/bdj.2008.192>
- Glenna, B. O. (2008). Naturalistic inquiry and the saturation concept: a research note. *Qualitative Research*, 8(1), 137-152. <https://doi.org/10.1177/1468794107085301>
- Hardman, J. (2005). An exploratory case study of computer use in a primary school mathematics classroom: New technology, new pedagogy? *Perspectives in Education*, 23(4), 99-111. Retrieved May 2019, from http://www.health.uct.ac.za/sites/default/files/image_tool/images/104/Hardman.pdf
- Kampouropoulou, M., Athanasiadis, I., & Stefos, E. (2011). Students' Views on the Use of New Technologies in Art Education: An Interdisciplinary Approach to Higher Education. *Review of European Studies*, 3(1), 60-70. Retrieved May 2019, from www.ccsenet.org/res <https://doi.org/10.5539/res.v3n1p60>

- Kawulich, B. (2005). Participant Observation as a Data Collection Method [81 paragraphs]. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 6(2), Art.43. Retrieved May 2019, from <http://nbn-resolving.de/urn:nbn:de:0114-fqs0502430>.
- Koehler, M. J., Mishra, P., Bouck, E., DeSchryver, M., Kereluik, K., Shin, T., & Wolf, L. (2011). Deep-play: Developing TPACK for 21st century teachers. *International Journal of Learning Technology*, 6(2), 146-163. doi:10.1504/IJLT.2011.042646
- Koehler, M., Mishra, P., Akcaoglu, M., & Rosenberg, J. (2013). The Technological Pedagogical Content Knowledge Framework for Teachers and Teacher Educators. *Commonwealth Education Media Center for Asia*, 1-8. Retrieved May 2019, from https://www.researchgate.net/publication/267028784_The_Technological_Pedagogical_Content_Knowledge_Framework_for_Teachers_and_Teacher_Educators
<https://doi.org/10.1504/IJLT.2011.042646>
- Kotrlik, J. W., & Redmann, D. H. (2009). Technology Adoption for Use in Instruction by Secondary Technology Education Teachers. *Journal of Technology Education*, 21(1), 44-59. Retrieved May 2019, from <https://scholar.lib.vt.edu/ejournals/JTE/v21n1/pdf/kotrlik.pdf>
<https://doi.org/10.21061/jte.v21i1.a.3>
- Kvale, S. (1996). *InterViews. An introduction to qualitative research interviewing*. Thousand Oaks London : Sage Publications.
- Lemon, N. (2015). Integrating digital technology into the K-12 classroom: Arts Education Insights. In N. Lemon, *Revolutionizing Arts Education in K-12 Classrooms through Technological Integration*. (pp. xiii -xxii). Chocolate Avenue Hershey PA: IGI Global. <https://doi.org/10.4018/978-1-4666-8271-9>
- Lin, C. (2011). A Learning Ecology Perspective: School Systems Sustaining Art Teaching with Technology. *Art Education*, 64(4), 12-18. Retrieved May 2019, from <https://doi.org/10.1080/00043125.2011.11519131>
- Luwangula, I. (2011). *Equipping Teachers with ICT Skills for Pedagogical Integration in Uganda: An Evaluation of Policy Implementation in Jinja Municipality*. Shanghai, China: East China Normal University (International Center of Teacher Education). Retrieved May 2019, from <https://www.grin.com/document/200562>
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook (2nd ed.)*. Thousand Oaks, California: Sage.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record.*, 108(6), 1017-1054. Retrieved May 2019, from http://one2oneheights.pbworks.com/f/MISHRA_PUNYA.pdf <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Onwuagboke, B. B., Singh, T. K., & Fook, F. S. (2015). Integrating Technology in Art Education in Nigerian Education System: The Need for an Effective Pedagogical Approach. *Mediterranean Journal of Social Sciences*, 6(4). <https://doi.org/10.5901/mjss.2015.v6n4s1p184>
- Örtegren, H. (2012). The scope of digital image media in art education. *Computers & Education*, 59, 793-805. <https://doi.org/10.1016/j.compedu.2012.03.021>
- Patton, M. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage .
- Peeraer, J., & Van Petegem, P. (2010). Factors Influencing Integration of ICT in Higher Education in Vietnam. . In Z. J. Abas, & J. Luca (Ed.), *Proceedings of Global Learn Asia Pacific 2010-Global Conference on Learning and Technology*. (pp. 916-924). Penang, Malaysia.: Association for the Advancement of Computing in Education (AACE). Retrieved 11 14, 2018, from <https://www.learntechlib.org/primary/p/34284/>
- Phelps, R., & Maddison, C. (2008). ICT in the secondary visual arts classroom: A study of teachers' values, attitudes and beliefs. *Australasian Journal of Educational Technology*, 24(1), 1-14. Retrieved May 2019, from <http://www.ascilite.org.au/ajet/ajet24/phelps.html>
<https://doi.org/10.14742/ajet.1226>
- Salavat, S. (2016). *Use of Digital Technologies in Education: The Complexity of Teachers' Everyday Practice*. Linnaeus University, Department of Informatics. Växjö, Sweden: Linnaeus University Press. Retrieved May 2019, from <http://lnu.diva-portal.org/smash/get/diva2:1039657/FULLTEXT01.pdf>
- Trainin, G., & Friedrich, L. A. (2014). Technological Pedagogical Content Knowledge in Teacher Preparation: Impact of Coaching Professional Development and Mobile Devices. *American Educational Research Association Annual Conference*. Philadelphia, Pennsylvania: Education and

- Human Sciences, College of (CEHS). Retrieved May 2019, from <https://digitalcommons.unl.edu/cehsgpirw/29/>
- Tusiime, W., Johannesen, M., & Gudmundsdottir, G. (2019). Developing Teachers' Digital Competence: Approaches for Art and Design Teacher Educators in Uganda. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 15(1), 133-149. Retrieved May 2019, from <http://ijedict.dec.uwi.edu/viewarticle.php?id=2556>
- Uganda. (2014). *National Information and Communications Technology Policy for Uganda*. Kampala: Ministry of Information and Communications Technology. Retrieved May 2019, from http://ict.go.ug/wp-content/uploads/2018/11/ICT_Policy_2014.pdf
- UNESCO. (2002). *Information and Communication Technologies in Teacher Education: A Planning Guide*. Paris: UNESCO. Retrieved May 2019, from <http://www.eldis.org/document/A10695>
- van Dijk, J. (2005). *The deepening divide: Inequality in the information society*. Thousand Oaks : Sage.
- van Dijk, J. (2017). Digital Divide: Impact of Access. (P. Rössler, Ed.) *The International Encyclopedia of Media Effects*, 1-11. <https://doi.org/10.1002/9781118783764.wbieme0043>
- Vrasidas, C., & McIsaac, M. S. (2011). Integrating Technology in Teaching and Teacher Education: Implications for Policy and Curriculum Reform. *International Council for Education Media*, 127-132. <https://doi.org/10.1080/09523980110041944>
- Wood, J. (2004). Open minds and a sense of adventure: how teachers of art & design approach technology. *International Journal of Art & Design Education*, 23(2), 179–191. Retrieved May 2019, from <https://doi.org/10.1111/j.1476-8070.2004.00396.x>
- Wood, R., & Griffiths, M. (2007). Online data collection from gamblers: Methodological issues. *International Journal of Mental Health and Addiction*, 5, 151-163. <https://doi.org/10.1007/s11469-007-9055-y>
- Yin, R. K. (2014). *Case Study Research: Design and Methods*. London: Sage.

Appendix 2: Article II

Article II

Tusiime, W.E, Johannesen, M. & Gudmundsdottir, G. (2019). Developing Teachers' Digital Competence: Approaches for Art and Design Teacher Educators in Uganda. *International Journal of Education and Development using ICT*, 15(1).
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Developing teachers' digital competence: approaches for Art and Design teacher educators in Uganda

Wycliff Edwin Tusiime and Monica Johannesen
Oslo Metropolitan University, Norway

Greta Bjork Gudmundsdottir
University of Oslo, Norway

ABSTRACT

The aim of this study is to establish an in-depth understanding of how art and design teacher educators (TEs) develop digital competences in teacher training institutions in Uganda. The study utilizes perspectives from Jan van Dijk's resources and appropriation theory as a conceptual lens to understand how art and design TEs develop digital competence for teaching in Uganda. Based on a case study design, semi-structured interviews and non-participant observations were employed to gather qualitative data from twenty-four informants who were purposively selected. The informants included ten TEs, ten teacher trainees and four administrators from two teacher training institutions in central Uganda. The findings indicate that art and design TEs develop digital competence through formal approaches, such as *continuous professional development* and *pre-service training*, and informal approaches, such as *collaboration*, *self-teaching* and *repetition*. The empirical findings contribute to the existing body of knowledge and provide an understanding of the development of teachers' digital competence in Uganda.

Keywords: *Teachers' Digital Competence, Teacher Education, Art and Design Education, Uganda*

INTRODUCTION

The world has witnessed a rapid digitalisation of education in the past decade (European Union, 2013; Farrell et al. 2007). In particular, there has been growing interest in the integration of digital technology in education. Such interest has often been premised on the assumption that digital technologies have great potential to improve the quality of education (Toit, 2015; UNESCO, 2009; Trucano, 2005). In Uganda, this interest has resulted in investments made by the government, its development partners and private individuals to increase the availability of digital technologies in schools and to support technology-driven pedagogy in teacher education programmes (Uganda, 2014; Mutonyi & Norton, 2007; Farrell, 2007; Uganda MoES, 2006). In the context of this global technological development, traditional teaching activities are coming under intense pressure from the rapid development of digital technologies (Säljö, 2010; Mishra & Koehler, 2006). In the context of this study, art and design education, which is concerned with the process of teaching and learning how to create and produce work in the visual and performing arts (Arts Education Partnership Working Group, 1993), has been transformed at all levels by digital technologies. Davis (2002) notes that art and design-making, whether in the professional world or in schools, is often aided by computer programs that allow artists to electronically create and manipulate images. This new possibility raises aesthetic questions about the nature of art and therefore requires art and design education programmes to develop teachers' digital competence (TDC) so they can apply technology in their teaching.

Digital competence requires a set of operational, informational and strategic skills (van Dijk, 2005). In recent years, studies (Hasniza et al., 2013; Chai et al., 2013) have reported that the effective use of digital technology in teaching requires teachers to develop knowledge of technology (digital hardware and software), pedagogy (methods of teaching), content (actual subject matter to be taught), and the intersection of these. Consequently, in this study we argue that teachers' digital competence (TDC) can best be developed when teachers understand and apply knowledge generated from the relationships between technology, pedagogy and content in their practice. This compound knowledge is also known as technological, pedagogical and content knowledge (TPACK), a theoretical approach which was developed by Mishra & Koehler (2006) and forms the concept of TDC in this study.

Developing TDC is a priority for many teacher education programmes worldwide. In Europe, for instance, this is widely reflected in government education reform, policies and frameworks (Ferrari, 2012; European Commission, 2007; OECD, 2003) and a number of scientific studies (Gudmundsdottir & Vasbø, 2017; Erstad, 2015; Johannesen, Øgrim & Giæver, 2014; van Dijk, 2012). In Africa, Makoe (2012) notes that teachers must be trained in how to use new digital technologies and integrate them into their own practice, while Gudmundsdottir (2010) calls for a policy focus on addressing the severe digital inequalities within and outside of the school environment to increase digital competence. According to Gudmundsdottir (2010), the aim is to ensure that technology is perceived not as an add-on but as an integral part of the curriculum. Similarly, the Uganda National Information, Communications and Technology (ICT) Policy for education (Uganda, MoES, 2006) sets a framework of curriculum and teacher training that facilitates and guides the development and integration of digital technology in all aspects of the education sector. The policy recognises the crucial role of teachers in implementing any education reform initiative and accordingly points out that focus must be put on developing TDC in line with the curriculum that teachers are expected to follow to ensure that the best use is made of digital tools.

However, although Uganda, like other nations, has been recognised for its efforts to integrate digital technology in teacher education (UNESCO, 2015; 2014), the use is still at the embryonic stage due to a lack of effective policies, basic infrastructure (electricity, devices, Internet), financial resources and teacher capacity (Ndiwalana & Tusubira, 2012). For almost ten years, studies in Uganda continue to reveal a gap between the technology available in classrooms and teachers' abilities to use this technology in teacher education programmes (Nakintu & Neema-Abooki, 2015; Andema, Kendrick, & Norton, 2013; Luwangula, 2011; Hennessy et al., 2010; Andema, 2009). The above studies report a limited use of digital technology in Uganda's teacher education programmes. Moreover, it has also been noted that the majority of teachers cannot even use the available digital resources as instructional tools due to inadequate digital skills (Bagarukayo, 2018; Wamakote, 2010; Nakabugo et al., 2008). With specific reference to the field of art and design education in Uganda, there are hardly any documented studies on how teacher educators (TEs) develop digital competence. It is therefore important for us to investigate how art and design TEs develop digital competence (TDC) within teacher training institutions (TTIs) in Uganda given the prevailing challenges as earlier noted. In the next section, we present the existing debates on the development of TDC in teacher education.

Developing teachers' digital competence (TDC) in teacher education

Teacher education today must consider the pedagogical use of digital technology to prepare student teachers for their future practice (Krumsvik, 2014:273). Moreover, Judge and O'Bannon (2008) note that previous studies have underlined the problem of teachers' lack of digital competence, which means that they cannot act as competent mentors for their students.

Similarly, Aduwa-Ogiegbaen (2014) indicates that studies in Africa have revealed that the majority of teachers lack essential technological knowledge and need extensive professional development to apply technology in teaching. In addition, Kirschner and Davis (2003) suggest that teacher education should focus on developing TDC so new teachers do not have to spend a great deal of time and energy enhancing their digital competence when starting their careers. In Uganda, teachers often fail to relate what they have learnt about digital technologies to their own practice (Uganda MoES, 2008).

Developing TDC does not solely involve educating teachers in understanding and using various emerging technologies that are relevant to their professional practice (Lund et al., 2014; van Dijk, 2005). Lund and his colleagues submit that it involves making teachers capable of using digital technology and learning resources in productive ways to transform their knowledge into discipline-specific didactics, classroom management techniques and assessments of how students productively use available digital resources. Van Dijk (2005) concurs and adds that people should be constantly learning digital skills through practice, which he suggests as, “the breeding ground of all digital skills” (p.90). He argues that the idea that digital skills are learned or should be learned in computer classes is a fallacy, claiming that these are not the most important ways of learning computer skills but rather provide a solid basis for digital skill development.

Røkenes and Krumsvik (2014) note that, in technology training situations, two or more student teachers collaborate by engaging in a common task in which each individual depends on and is accountable to each other to maximise their own and other’s learning. So and Kim (2009) and Koehler et al. (2007) add that collaborative approaches help teachers make intimate connections between technology, pedagogy and content. As active and constructive processes (Laurillard, 2009; Smith & MacGregory, 1992), collaborative practices in teacher education enable teachers to easily develop new knowledge and competences, which later are used to create new meaning. In countries like Uganda where teachers still report limited access to digital technologies (Andema, Kendrick, & Norton, 2013), collaboration remains a suitable approach to developing TDC, as teachers can collaborate and share the few digital resources available.

In addition, research indicates that teachers’ experiences and practices with technology influence the successful development of TDC (Benali et al., 2018; U.S National Center for Education Statistics, 2000; Lau & Sim, 2008; Russell et al., 2003, Kaasbøll, 2014). Kaasbøll notes that when technology users are properly trained in the pedagogical use of digital technology and continue to practice through repetition, the skill becomes automated and can enhance digital competences. Similarly, the U.S National Center for Education Statistics (2000) reported that teachers with less teaching experience were more likely to integrate computers with their teaching than those with more experience. However, Lau and Sim (2008) found that the latter use computer technology in the classroom more than the teachers with less experience. Although findings from the two studies are contradictory, the primary reason could be that, in both cases the teachers’ experience and continuous practice with computer technology enhanced their digital competences for pedagogical purposes. In Uganda, teacher education programmes are frequently criticised for their failure to provide teachers with the necessary hands-on training to utilise digital technologies pedagogically (Uganda, 2014; Mutonyi & Norton, 2007).

Furthermore, modelling has traditionally been used in teacher education around the world to develop digital competence (Dorgu, 2015). While the approach is criticised for hindering creativity, as the students only mimic their teacher (Dorgu, 2015), it helps students develop interest and motivation through their active participation in the teaching and learning process (van Dijk, 2005). This might be a challenge in Uganda, where there are more students than teaching resources like computers and related instructional materials like textbooks (Nakabugo, Opolot-Okurut, Ssebbunga, Maani, & Byamugisha, 2008).

Equally important, traditional teaching curricula and training programmes can enhance digital skills and help develop TDC. In particular, digital technologies enable interactions between educators and students, provide multimedia interfaces that facilitate learning and increase flexibility in the delivery of training (UN, 2018). Though this is important, many developing countries like Uganda still demand the development and integration of subject-based digital curricula into teacher education programmes (Uganda, 2014). In their study, Ndawula et al. (2013) indicate that some teachers had no ICT training component in their professional teacher education programmes. Instead, ICT as a separate subject was recently introduced to secondary education and is offered at some TTIs.

Overall, the body of knowledge presented above reflects a few approaches to developing TDC in teacher education. However, there is limited evidence on the development of TDC in teacher education in Uganda and in the field of art and design in particular. This knowledge gap, in addition to inadequate access to digital technologies, calls for further studies to establish how TDC is developed in Uganda's teacher education programmes. Thus, the following objective and research question guide this study:

Objective of the Study

To establish an in-depth understanding of how art and design teacher educators (TEs) develop digital competences in teacher training institutions in Uganda.

Research Question

How do art and design TEs develop digital competence for teaching in TTIs in Uganda?

THEORETICAL FRAMEWORK

In this study, we draw on perspectives from van Dijk (2005) resources and appropriation theory, which has previously been used to describe how multi-faceted theorizing the digital divide is (van Dijk, 2017). The core idea of the theory is the particular relationships between four circumstances (categorical inequalities, resource distribution, access to ICTs and participation in society) in a process of creating digital inequality when using digital technologies. Van Dijk (2005, p.15) summarised the relationship in the following way:

1. Categorical inequalities (personal and positional) in society produce an unequal distribution of resources. The *personal* categorical inequalities are age, gender, race/ethnicity, intelligence, personality and health, whereas the *positional* categorical inequalities include labour position, education, household and nation.
2. Unequal distributions of resources (temporal, material, mental, social and cultural) cause unequal access to digital technologies.
3. Unequal access to digital technologies also depends on the characteristics of these technologies and brings about unequal participation.
4. Unequal participation reinforces categorical inequalities and unequal distributions of resources.

In this study, we focus on "access" to digital technologies as the component of the theory that can help us understand how art and design TEs develop TDC for teaching in Uganda's TTIs. Van Dijk (2005, p.21) addresses four kinds of "access" to digital technologies as shown in Figure 1, namely:

motivational access (motivation to use digital technology), material or physical access (possession of computers and internet connections or permission to use them and their contents), skills access (possession of digital skills: operational, informational and strategic skills) and usage access (number and diversity of applications, usage time).

Subsequently, these stages are recursive, as they return, wholly or partly, with new technology or innovation.

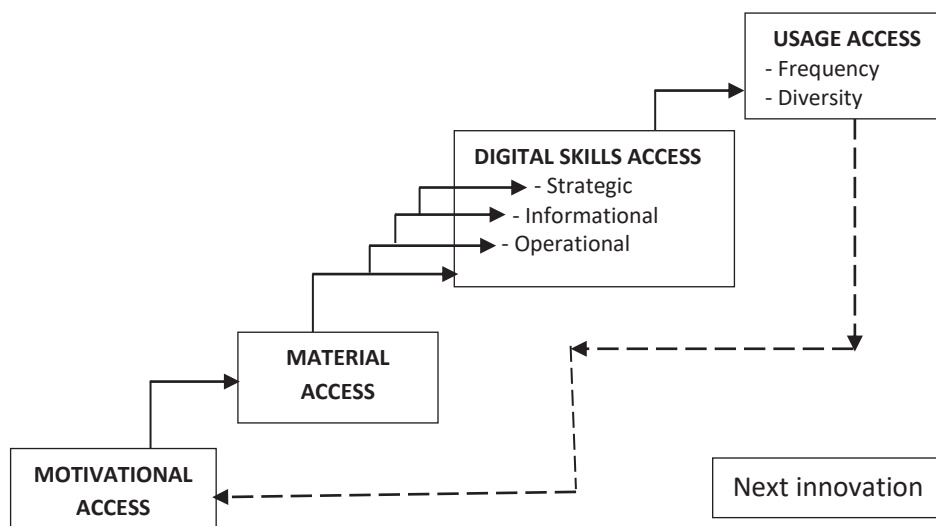


Figure 1: Model of successive kinds of access to digital technologies
 Source: van Dijk, 2005, p.22

According to van Dijk (2005), to appropriate a new technology, one must first be motivated to use it. Motivational access relates to attitude and the intention to accept and learn the requisite skills and uses of new digital technologies. Motivation is often affected by social, cultural, mental or psychological factors, including lack of interest, time, money, skills and self-confidence (van Dijk, 2017). Van Dijk argues that, when sufficient motivation is developed, one should be able to develop physical access.

Van Dijk (2005) describes material or physical access as possession of or access to hardware, operational software or other digital technologies as well as permission to use them (for instance, user names, passwords and membership). Physical access can occur at work, school or public places such as libraries and internet cafes, as well as at home or in transit on a laptop, PDA or mobile phone. Physical access to digital technology is mostly influenced by one’s income, among other factors like level of education, age and gender. According to van Dijk (2005), having material or physical access is a necessary condition for the development of the requisite digital skills to use technology.

Van Dijk (2005, p.73) defines *digital skills* as a collection of skills needed to operate digital technologies like computers and their networks: to search for and use information for one’s own purposes. He divides the concept into three types of skills: operational skills (skills used to operate hardware and software), information skills (skills needed to search, select, process and evaluate information from computer and network sources) and strategic skills (capacities to use digital sources to achieve specific and general goals). Further, he acknowledges that the

development of digital skills can occur through formal and informal approaches. Formal approaches in this context refer to organised and structured training systems with learning objectives in school or the workplace. On the other hand, informal approaches denote developing digital skills from daily experiences and interest. Consequently, the development of digital skills is often a matter of learning through practice, by trial and error, and with help from peers (van Dijk, 2005).

Furthermore, van Dijk (2005) argues that, even given sufficient motivation, physical access and digital skills are necessary but not sufficient conditions for actual use. A user must also have the need, occasion, obligation, and time to actually use technology. Usage can either support or impede access and is determined by properties of digital technology related to hardware, software and content. The technological properties of digital technology related to hardware and software are complexity, expense, network effects, multiple facets and multiple functions, while those related to content are approachability, usability, information overload, culture and language, relevant information and conditional access (van Dijk, 2005, p.96-105). As a dependent factor, van Dijk (2005) argues that usage can be measured in at least four ways: usage time and frequency, number and diversity of usage applications and more or less active or creative use.

To sum up, van Dijk's emphasis on digital skills development through formal and informal approaches is useful to this study as it allows us to analyse how art and design TEs develop TDC. In particular, knowledge informed by van Dijk's scientific perspectives on the kinds of digital skills access (operational, informational and strategic) can illuminate how different types of digital skills and forms of learning play a role in developing TDC.

METHODS

This study explores how art and design TEs from two TTIs, Kabwohe and Sheema (pseudonyms) in central Uganda develop TDC for teaching. A case study design (Yin, 2014) is preferred in addressing the research question because it allows detailed data collection even within small samples, which would not be possible with other types of research designs. The case study approach enables in-depth description of a case or multiple cases under investigation (Creswell, 2007) and provides rich and in-depth data to gain deep understanding (Denzin & Lincoln, 2005) into the phenomena under investigation.

Isaac and Micheal (1995) posit that research involving small sample sizes is justifiable when it involves an in-depth case study that provides a great amount of qualitative data from each informant, as is the case in this study. Purposive sampling was used as it enables choosing research informants who will yield insights and in-depth understanding of the research questions rather than empirical generalisations (Patton, 2002; Miles & Huberman, 1994). Therefore, we purposively selected the total sample of twenty-four informants to include ten TEs, ten teacher trainees (TTs) and four administrators (ADs) from two TTIs in Uganda. Due to a small number of available Art and Design TEs at Sheema, three TEs were included. The rest of the informants (TTs and ADs) were equally selected from both institutions. Although this study focuses on TEs, it was necessary to include opinions from TTs and ADs because they are key stakeholders in the development of TDC. In the Ugandan context, TEs may include lecturers, tutors, instructors, technicians and studio or laboratory attendants at different levels of teacher education. TTs are included because they are studying to become teachers and directly observe TEs' classroom instruction and digital practices. In addition, ADs are responsible for overseeing the daily teaching or managerial operations in the TTIs and thereby have knowledge on the conditions necessary for developing TDC.

Semi-structured interviews and observations were used as methods to explore the views, experiences, beliefs and motivations of individual informants in relation to the research question, which provided reliable and comparable data (Gill et al., 2008; Hardman, 2005; Barriball & White, 1994). Data were collected between March 2017 and July 2018. During this period, interviews were conducted with the individual informants at their convenience lasting for an average of one hour. In addition, two TEs from each institution were observed engaging in classroom practice to analyse the TEs' behaviour and interaction with digital tools in the classrooms. This was done to identify discrepancies between data sources or events that informants might be reluctant to share as well as to observe situations informants described during interviews. The interviews were audio recorded and then transcribed into text along with the other data obtained from observations (such as field notes and comments made during observation).

Miles and Huberman (1994) posit that valid analysis is immensely aided by data displays that are focused enough to permit viewing a full data set in one location and are systematically arranged around the research question. In this study, the data from the transcripts was organised by specific questions in the interview guide in table charts created in Microsoft Word. This made it easier to identify words and phrases that frequently emerged from the responses to each question and were related to the main research question. These words and phrases were colour-coded, and similar codes were later clustered to create categories.

Marshall and Rossman (1995) observe that identifying salient themes, recurring ideas or language and patterns of belief that link people and settings together is the most intellectually challenging phase of analysis and can integrate the entire endeavour. Indeed, the categories in this study identified were collapsed into two main over-arching themes emerging from van Dijk (2005), namely those of formal and informal approaches to learning.

Although qualitative methods like interviews and observations can yield rich and informative data, they can be criticised for their subjectivity (Wood & Griffiths, 2007). Such subjectivity may compromise the validity and reliability of the data being collected. For this reason, triangulation was employed by assessing and comparing data collected through interviews and observations of the informants. Secondly, during interviews and observations, attention was taken not to influence the informant's opinions by allowing them to freely express their views and perform classroom activities respectively. Thirdly, to ensure quality of data, the data collection instrument (interview questions) was piloted with a group of experts in the area of this research who provided feedback on the clarity of the tool with reference to the research question.

Ethical issues were addressed by protecting the identity of the institutions and informants by use of pseudonyms and codes, respectively. To further increase the validity of the data, immediate feedback was received from each informant after reading through and approving his or her transcribed interview or observation reports.

FINDINGS

The main question in this study was: *How do art and design TEs develop digital competence for teaching in TTIs in Uganda?* The answer to this question is organised by the two over-arching themes of 'formal' and 'informal' approaches to learning derived from van Dijk (2005). Each of the response categories that emerged from the data, were linked to the research question after the coding process. Furthermore, these categories were associated with a relevant theme in the ensuing sub-sections.

Formal Approaches

Continuous professional development (CPD): All TEs reported having been engaged in CPD activities, including workshops and seminars, conferences, presentations, orientation, technical support, online training, mentoring, peer coaching and research development projects. Several TEs recounted that although they had gained some digital competences from CPD activities, such knowledge remains theoretical and is not specific to their teaching subjects; application of such knowledge in real classroom practice is difficult due to inadequate digital infrastructure. On this point, one of the TEs stated:

We have been trained through our internal CPDs, informal workshops and seminars. We have learnt how to do filming and video production, and how to construct LMS [Learning Management System] and upload e-content, making multimedia content, podcast and using games in class. The latest was how to make cartoons (animation). Actually, UNESCO has been funding the training. I am limited to use the skills because we do not have enough digital resources... (TE#3)

The above statements relate to the situation observed in classrooms at both institutions in which some TEs used traditional teaching methods like “chalk and talk” and lecturing to deliver content in digital classrooms. In such situations, lesson delivery was more theoretical and trainees were encouraged to visit computer laboratories to explore and practice on their own after the lesson. At one of the TTIs, an educator was observed grouping 150 trainees into teams of fifteen to work together on the assignment, thus dividing the ten computers in the computer lab between the groups.

All ADs agreed that training in the use of digital technologies is sometimes conducted to ensure TEs develop or upgrade their digital competences. One AD added that such training mainly provided general knowledge on the use of digital tools rather than digital competences required by art and design teachers:

...through our online Learning Management System, a platform we have designed for professional development, our teachers have acquired varied knowledge concerning use of ICT in teaching. However, we have no specific courses or training for art and design teachers.... (AD#1)

Pre-service training: Several of the TEs interviewed acknowledged having taken one or more ICT courses as a component of their professional academic programmes during pre-service training. However, most TEs reported that these courses did not help them develop specific digital competencies required in their subject area and that they could not make practical use of the knowledge provided in the classrooms. Most TEs reported gaining sufficient general skills to use digital tools like a computer, word processors and PowerPoint:

I have attained some formal training in office suite basics; I have done online training in commonwealth of learning. UNESCO has also helped us in so many ways. We have had training in integration of ICT. The competencies are generalized.... (TE#2)

All TTs interviewed confirmed the existence of ICT courses in their pre-service training programmes. More than half of the TTs at both TTIs, indicated that the ICT courses they attended were offered as distinct courses rather than as an integral part of art and design subjects. TTs also reported that TEs often did not provide enough time for TTs to learn the practical uses of digital tools. At Sheema, for instance, all the informants reported that computer studies were not given due attention by TEs because it was examined by neither the institution nor the national examination body. In relation to this, one administrator reported that:

...of course some teachers reschedule the time allocated for computer lessons to teach other examinable subjects because computer studies is not examinable either by the institution or the national examination body. It is added on the timetable to benefit our students... (AD#4)

Informal Approaches

Collaboration: Interestingly, all the TEs reported developing TDC through informal collaborations with fellow educators, students, peers, technical persons and experts to co-teach, work together on specific projects that require the use of technology and exchange digital knowledge and experiences. Two TEs had this to say with regard to collaboration:

I collaborate with teachers; for example in teaching multimedia crafts that require knowledge on textile technology; I consult textile teachers to guide my students on how to use specific digital tools that I do not have expertise, through which I learn in the process (TE#5)

I collaborate with other technical people, especially when the tool is new; we share knowledge. Sometimes I either call upon a person who is more specialized with that equipment or software to give an advance briefing... (TE#1)

Similarly, all the TTs reported collaborating with peers either at school or outside school to learn how to use computers, smart phones and software applications. At Kabwohe, TTs frequently reported developing skills in Adobe Creative Suite applications like Illustrator and Photoshop through informal collaborations with friends. One of the TTs noted:

...I believe collaborating with colleagues is crucial if I am to become digitally competent, especially in this dynamic world. Through interacting and sharing with colleagues about my digital challenges, I am helped, and so far in most of my lectures I use a number of digital tools including; computers, camera as well as projectors... (TT#2)

Furthermore, through classroom observation, it was evident that there were collaborative practices among TEs and TTs. At Kabwohe, two TEs were observed co-teaching in a computer aided design class, and groups of TTs were observed discussing how to model a 3D cartoon in Autodesk Maya, an application that the TEs had briefly explained. Most times, students were observed actively working together in groups, sharing personal laptops and helping each other learn. Due to the limited number of computers and other digital tools, TEs often encouraged students to work in groups on tasks that required the use of digital technology. Both TEs and TTs acknowledged learning from each other through collaboration.

Self-teaching: It was evident from the findings that TEs develop TDC through self-teaching, understood in this study as one's own efforts to acquire knowledge or skills without instruction or collaboration with peers. Informants reported to have done this through trial and error, engaging in self-directed activities related to technology use. In this regard, one TE stated:

...sometimes when you are in a school environment and you are assigned a certain subject that necessitates to use a certain digital tool, you have no way out but to take a self-initiative and search for the tool you need in that subject and learn to use it. (TE#7)

In addition, several TEs reported independently searching for information on particular topics related to teaching with technology in the art and design field, mainly from online sources. Here, TEs cited Google, electronic journals and YouTube, along with relevant textbooks in the library. Some of the TEs reported watching video tutorials, observing their colleagues using digital tools, exploring digital tools (social media) and reading operational manuals. Several TEs reported applying the competences gained through self-teaching later in their practice to prepare and present digital content. For example:

...there is a lot of scholarly information about the use of digital tools in the teaching process on the internet. For instance, how to use a computer in graphics design and art education. This information is both available in text and video, say on YouTube. So when I read or watch a video, I learn and later apply the knowledge in my teaching practice... (TE#4)

Likewise, all ADs interviewed at both TTIs agreed that some TEs developed TDC through self-initiatives like discovery and self-teaching. One of the ADs reported:

... the integration of digital technologies like computers and the internet at the institution has made it possible for teachers and trainees to discover how certain technologies operate through internet searches. This has helped to boost teachers' knowledge and competence in using technology for teaching, as teachers utilize the information searched to prepare teaching content... (AD#5)

Similarly, the classroom observations at both TTIs revealed that TEs encouraged TTs to use Internet websites like *Google* and *YouTube* to learn more on their own about topics discussed in class. In one of the class observations, TTs were often seen browsing the Internet on the topic being discussed, using their smart phones without guidance from the teacher.

Repetition: Roughly, half of TEs reported acquiring TDC through repetition, understood in this study as developing a skill through the regular and routine use of digital technologies. TEs broadly reported doing this through regular practice whenever they had access to digital tools. This way, some TEs reported developing positive attitudes and motivation towards technology use in teaching:

....the use of digital tools requires regular practice; thus the moment you stop, the next day it will be outdated. By constantly using the computer in new ways as I teach, my attitude and motivation levels develop. Thus at the end my digital competence is improved. (TE#9)

Similarly, some ADs when asked how TEs develop digital competence at the institutions confirmed that TEs regularly used digital tools in the classroom. One AD had this to report:

...most times teachers whose attitude towards technology use is positive are always using digital tools; they are in the computer lab, whatever information they need, they access it so fast...(AD#2: at Kabwohe TTI)

Although repetition was identified as a major informal approach through which teachers developed TDC, it was observed in the classrooms that only a few TEs had access to personal digital tools like computers. At Kabwohe, one TE did not possess a laptop computer and had to ask TTs to volunteer their personal computers to use in conducting a lesson. In addition, both TTIs in general did not have enough digital tools either for the TEs to use in teaching or for TTs to practice. Moreover, a large proportion of the informants also reported not owning personal digital tools as a challenge to developing TDC. Furthermore, it was observed at both TTIs that TEs

would give instructions on how to perform certain tasks that required the use of digital tools without having adequate tools to demonstrate, and TTs would be left to practice such tasks in their free time.

In summary, the findings mainly indicate that art and design TEs develop TDC through both formal and informal approaches. The formal approaches include *CPD* and *pre-service training*, whereas informal approaches include *collaboration*, *self-teaching* and *repetition*. Apparently, TDC gained through formal approaches did not relate specifically to the teaching of art and design subjects, making it inadequate and difficult to apply in real classroom practice. Second, the findings suggest to a larger degree that TEs develop moderate TDC, necessary for practical use in the classroom, through informal approaches. Through collaboration, TEs share knowledge and experiences and participate together with digitally competent persons to develop skills. Even without professional guidance, TEs develop skills on their own (self-teaching) through trial and error, tutorials, Internet resources and the regular and routine (repetition) use of digital technologies. Finally, the findings confirm that TEs' inadequate physical access to digital resources limits the development of TDC.

DISCUSSION

The findings of this study indicate that TDC gained through formal approaches was overly generic and not specific to the teaching of art and design subjects, thus being inadequate and difficult to apply in art and design classrooms. The present finding seems to be consistent with van Dijk's (2005, p.90) study where he indicates that "computer courses and books are not the most important sources for learning computer skills". While van Dijk underscores the importance of formal education in setting a solid basis for digital skill development, the present findings clearly show a mismatch between formal education and digital skills access. With formal ICT courses in this study being distinct rather than an integral part of art and design subjects, they provide only moderate competence in using software and hardware. Taking into account the inadequate physical access to digital resources at both TTIs, it is evident that TEs will continue to find it difficult to fully develop the informational and strategic skills that are required to develop TDC. In this sense, future formal training needs to arrange for a better way to meet the informational and strategic skill needs of TEs.

An interesting finding in this study is how TEs develop TDC to a large degree through informal approaches. This finding corroborates the ideas of van Dijk (2005), who maintained that developing digital skills through informal approaches has been common for many years even in formal educational settings. These learning opportunities occur informally or incidentally as students and experts observe, imitate, experiment, model, appropriate and provide and receive feedback (van Dijk, 2005).

First, the findings of this study reveal that informal collaborations with persons who possess digital competence is of utmost importance. TEs seek collaboration with and assistance from more digitally competent persons to develop TDC. This finding resonates with So & Kim (2009) and Koehler et al. (2007), who have observed that collaborative approaches help teachers make intimate connections between technology, pedagogy and content from which they develop the compound competence necessary to use digital technology. This collaboration further serves both operational and informational purposes, as collaborative exploring concerns knowledge about how to use digital tools and integrate them into classroom practice. This study also reveals that collaboration with peers helps develop strategic skills to achieve the specific goals of using digital tools in classroom practice.

Second, the development of TDC through self-teaching as reported in the findings, further supports the idea of van Dijk (2005, pp. 90), who argued that “the do-it-yourself approach is a much more important source of learning digital skills”. The present study found that TEs have developed digital skills through trial and error, tutorials and Internet use. Although this training has been conducted without professional guidance, it serves to develop informational skills, providing knowledge about searching, selecting, processing and evaluating information in a networked society. Van Dijk adds that most computer and Internet users learn by trial and error; however, he maintains that, “operational skills will remain incomplete when they are only learned by trial and error” (2005, p.92). This could make it difficult for TEs to recognise the relationships between technology, pedagogy and content that constitutes TDC without a particular focus on the educational purpose of technology use. Hence, according to findings of this study, acquisition of TDC through self-teaching may not be an adequate approach to achieving strategic skills.

Finally, the findings indicate that repetition (regular and routine use of digital technologies) is a significant informal approach through which TEs develop TDC. In accordance with the present finding, van Dijk (2005) observes that people learn operational skills through regular practice with digital technologies. Kaasbøll (2014) concurs and adds that when technology users continue to practice through repetition, such skills become automated and could enhance their digital competences. However, van Dijk adds that learning from regular practice could limit understanding of all the aspects of digital skills (operational, informational, and strategic) that do not immediately appear to be relevant. This implies that, while TEs develop TDC through repetition, it is vital for TEs to develop the compound and complex skills needed to use digital technologies in their classrooms.

In summary, this study indicates that formal approaches will have less relevance to the development of TDC as long as they fail to address all aspects of digital skills (operational, informational and strategic). In this study, digital skills gained through formal training remained operational and were not specific to the teaching of art and design subjects, thus being inadequate and difficult to apply in real art and design classroom practice. On the other hand, through informal approaches, TEs to a larger degree have developed elements of TDC. However, due to inadequate or non-existent professional guidance within informal approaches, TEs seem to have mostly gained operational skills and only to a lesser degree, the informational and strategic skills that typically are learned from formal education designed for professional practice. It is also important to note that inadequate physical access to digital resources could have prevented TEs from fully developing the necessary TDC required for the actual use of technology in art and design classrooms.

CONCLUSION

The aim of this study was to establish an in-depth understanding of how art and design TEs develop TDC for teaching in TTIs in Uganda. Notably, the findings indicate that TEs develop moderate TDC through informal approaches that include *collaboration, self-teaching and repetition*, which support both operational and informational skills but restrict the acquisition of strategic skills that address the compound knowledge of TDC. To a lesser degree, TEs develop TDC through formal approaches that include *CPD and pre-service training*. The skills gained through formal approaches remain operational and are not specific to the teaching of art and design subjects, which makes them inadequate and difficult to apply in real classroom practice. The findings suggest the need for implementing a curriculum that will not only help realise operational skills but also informational and strategic ones. These skills must be fully integrated into all traditional art and design subjects to create a subject-based digital curriculum to enable the development of the TDC required to use digital technologies in the classroom. Finally, there is also an urgent need to consider integrating the strength of informal approaches to the development of TDC into formal art and design education curricula.

LIMITATIONS AND FURTHER RESEARCH

The current study only examined the development of TDC in terms of the digital skills necessary for teacher educators to appropriate digital technologies in the art and design classrooms. However, van Dijk (2005) argues that, even given sufficient motivation, physical access to digital technologies and the skills to apply them are necessary but not sufficient conditions for the actual use of such technologies in the classroom. It would therefore be interesting to investigate the motivation and physical access of teacher educators as well as establish how teacher educators actually use digital technologies in teaching art and design classes in Uganda.

REFERENCES

- Aduwa-Ogiegbaen, S. E. O., (2014). Nigerian inservice teachers' self-assessment in core technology competences and their professional development needs in ICT. *Journal of Computing in Teacher Education*, vol. 26, no. 1, pp. 17-28.
- Andema, S., (2009). *Digital literacy and teacher education in Uganda: The case of Bondo Primary Teachers' College*, Vancouver: unpublished M.A dissertation, Faculty of Education, University of British Columbia.
- Andema, S., Kendrick, M. & Norton, B., (2013). *Digital literacy in Ugandan teacher education: Insights from a case study, Reading and writing.*, s.l.: <http://dx.doi.org/10.4102/rw.v4i1.27>.
- Arts Education Partnership Working Group, (1993). *The Power of the Arts to Transform Education.*, Washington, DC: John F. Kennedy Center for the Arts.
- Bagarukayo, E., (2018). Social media use to transfer knowledge into practice and aid interaction in higher education. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, vol. 14, no. 2, pp. 210-231.
- Barriball, K. & White, A., (1994). Collecting data using a semi-structured interview: A discussion paper. *Journal of Advanced Nursing*, vol. 19, pp. 328-335.
- Benali, M., Kaddouri, M. & Azzimani, T., (2018). Digital competence of Moroccan teachers of English. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, vol. 14, no. 2, pp. 99-120.
- Chai, C. S., Koh, J. H. L. & Tsai, C. C., (2013). A review of technological pedagogical content knowledge.. *Educational Technology & Society*, vol. 16, no. 2, pp. 31-51.
- Creswell, J., (2007). *Qualitative inquiry and research design: Choosing among five approaches*. 2nd ed. Thousand Oaks, CA: Sage.
- Davis, D. J., (2002). Art education, preparation of teachers. In: J. W. Guthrie, ed. *Encyclopedia of Education*. 2nd ed. New York: Macmillan, pp. 121-123.
- Denzin, N. K. & Lincoln, Y. S., (2005). *The Sage handbook of qualitative research*. 3rd ed. London, New Delhi: Sage Publications.

- Dorgu, T. E., (2015). Different teaching methods: A panacea for effective curriculum implementation in the classroom. *International Journal of Secondary Education. Special Issue: Teaching Methods and Learning Styles in Education*. 3(6-1) doi: 10.11648/j.ijssedu.s.2015030601.13, pp. 77-87.
- Erstad, O., (2015). Educating the digital generation. Exploring media literacy for the 21st century. *Nordic Journal of Digital Literacy*, vol. 5, no. 1, pp. 56–71.
- European Commission, (2007). *Key competences for lifelong learning. European reference framework*, Luxembourg: Office for Official Publications of the European Communities..
- European Union, (2013). *Survey of schools: ICT in education. Benchmarking access, use and attitudes to technology in europe's schools*, Belgium: European Union.
- Farrell, G., (2007). *Survey of ICT in education in Uganda*, Washington, DC: infoDev/World Bank.
- Farrell, G., Isaacs, S. & Trucano, M., (2007). *Survey of ICT and education in Africa (2)53 Country Reports*, Washington, DC: infoDev / World Bank..
- Ferrari, A., (2012). *Digital competence in practice: An analysis of frameworks*, Luxembourg: Joint Research Centre of the European Commission.
- Gill, P., Stewart, K., Treasure, E. & Chadwick, B., (2008). Methods of data collection in qualitative research: Interviews and focus groups. *British Dental Journal*, vol. 204, no. 6, pp. 291-295.
- Gudmundsdottir., G., (2010). From digital divide to digital equity: Learners' ICT competence in four primary schools in Cape Town, South Africa. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, vol. 6, no. 2, pp. 84-105 .
- Gudmundsdottir, G. & Vasbø, K., (2017). Toward improved professional digital competence: The use of blended learning in teacher education in Norway. In: *Proceedings of Society for Information Technology & Teacher Education International Conference 2017*. Chesapeake, VA: Association for the Advancement of Computing in Education (AACE), pp. 499-509.
- Hardman, J., (2005). An exploratory case study of computer use in a primary school mathematics classroom: New technology, new pedagogy?. *Perspectives in Education*, vol. 23, no. 4, pp. 99-111.
- Hasniza, N., Niki, D. & Tengku, F. T. A., (2013). A case study of secondary pre-service teachers' technological pedagogical and content knowledge mastery level. *Procedia - Social and Behavioral Sciences*, vol. 103, no. 1, pp. 1-9.
- Hennessy, S. et al., (2010). *Developing the use of information and communication technology to enhance teaching and learning in East African schools: Review of the Literature*, East Africa: Centre for Commonwealth Education & Aga Khan University Institute for Educational Development – Eastern Africa Research Report No. 1.
- Isaac, S. & Micheal, W., (1995). *Handbook in research and evaluation*. "What sample size is 'enough' in internet survey research"? . In: R. Hill, ed. s.l.:Interpersonal Computing and Technology.An electronic Journal for the 21st Century.

- Johannesen, M., Øgrim, L. & Giæver, T. H., (2014). Notion in motion: Teachers' digital competence. *Nordic Journal of Digital Literacy*, vol. 9, no. 4, pp. 300-312.
- Judge, S. & O'Bannon, B., (2008). Faculty integration of technology in teacher preparation: Outcomes of a development model. *Technology, Pedagogy and Education*, vol. 17, no. 1, pp. 17-28.
- Kaasbøll, J., (2014). *Developing digital competence - learning, teaching and supporting use of information technology*. Oslo: University of Oslo.
- Kirschner, P. & Davis, N., (2003). Pedagogic benchmarks for information and communications technology in teacher education. *Technology, Pedagogy and Education*, vol. 12, no. 1, pp. 125-147.
- Koehler, M. J., Mishra, P. & Yahya, K., (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy and technology. *Computers & Education*, vol. 49, no. 3, pp. 740-762.
- Krumsvik, R., (2014). Teacher educators' digital competence. *Scandinavian Journal of Educational Research*, vol. 58, no. 3, pp. 269–280.
- Laurillard, D., 2009. The pedagogical challenges to collaborative technologies. *International Journal of Computer-Supported Collaborative Learning*, 4(1). Retrieved from <http://dx.doi.org.ezproxy.hioa.no/10.1007/s11412-008-9056-2>, pp. 5-20.
- Lau & Sim, (2008). Exploring the extent of ICT adoption among secondary school teachers in Malaysia. *International Journal of Computing and ICT Research*, vol. 2, no. 2, pp. 19-36.
- Lund, A., Furberg, A., Bakken, J. & Engelién, K. L., (2014). What does professional digital competence mean in teacher education?. *Nordic Journal of Digital Literacy*, vol. 9, no. 4, pp. 281-299.
- Luwangula, I., (2011). *Equipping teachers with ICT skills for pedagogical integration in Uganda: An evaluation of policy implementation in Jinja municipality*.
- Makoe, M., (2012). Teaching digital natives: Identifying competencies for mobile learning facilitators in distance education. *South African Journal of Higher Education*, vol. 26, no. 1, pp. 91-104.
- Marshall, C. & Rossman, G., (1995). *Designing qualitative research*. Thousand Oaks, California: Sage Publications.
- Miles, M. B. & Huberman, A. M., (1994). *Qualitative data analysis: An expanded sourcebook*. 2nd ed. Thousand Oaks, California: Sage.
- Mishra, P. & Koehler, M. J., (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, vol. 108, no. 6, pp. 1017-1054.
- Mutonyi, H. & Norton, B., (2007). ICT on the margins: Lessons for Ugandan education. *Language and Education*, vol. 21, no. 3, pp. 264-270.

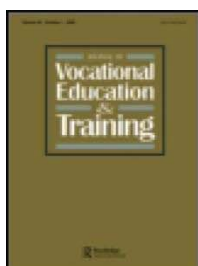
- Nakabugo, M. G. et al., (2008) . Large class teaching in resource-constrained contexts: Lessons from reflective research in Ugandan primary schools. *Journal of International Cooperation in Education*, vol. 11, no. 3, pp. 85-102.
- Nakintu, R. & Neema-Abooki, P., (2015). Usability of computers in teaching and learning at tertiary institutions in Uganda. *African Journal of Teacher Education*, vol, 4, no. 1.
- Ndawula, S., Kahuma, B. J., Mwebembezi, J. & Masagazi, J. Y., (2013). Getting schools ready for integration of pedagogical ICT: The experience of secondary schools in Uganda. *International Journal of Academic Research in Business and Social Sciences*, vol. 2, no. 3.
- Ndiwalana, A. & Tusubira, F., (2012). *Understanding what is happening in ICT in Uganda: A supply- and demand side analysis of the ICT sector*, Cape Town, South Africa: Research ICT Africa.
- OECD, (2003). *Education at a glance 2003 OECD Indicators: OECD Indicators*. Paris: OECD Publishing.
- Patton, M., (2002). *Qualitative research and evaluation methods*. 3rd ed. Thousand Oaks, CA: Sage.
- Russell, M., Bebell, D., O'Dwyer, L. & O'Connor, K., (2003). Examining teacher technology use: Implications for preservice and inservice teacher preparation.. *Journal of Teacher Education*, vol. 54, no.4, pp. 297-310.
- Røkenes, F. M. & Krumsvik, R. J., (2014). Development of student teachers' digital competence in teacher education- A literature review.. *Nordic Journal of Digital Literacy*, vol. 9, no. 4, pp. 250-280.
- Smith, B. & MacGregory, (1992). *What is collaborative learning? In collaborative learning: A source book for higher education*. University Park, PA: National Centre on Post-Secondary Teaching, Learning and Assessment (NCTLA).
- So, H. & Kim, B., (2009). Learning about problem based learning: Student teachers integrating technology, pedagogy and content knowledge. *Australasian Journal of Educational Technology*, vol. 25, no. 1, pp. 101-116.
- Säljö, R., (2010). Digital tools and challenges to institutional traditions of learning: Technologies, social memory and the performative nature of learning. *Journal of Computer Assisted Learning*, vol. 26, pp. 53-64.
- Toit, J. D., (2015). *Teacher training and usage of ICT in education: New directions for the UIS global data collection in the post-2015 context*, Montreal: UNESCO Institute for Statistics.
- Trucano, M., (2005). *Knowledge maps: ICTs in education*, Washington, DC: infoDev/World Bank.
- Uganda, (2014). *Enhancing teacher education for bridging the education quality gap in Africa: Needs assessment framework of teacher training and development to ensure education for all (EFA)*. Kampala: Ministry of Education and Sports..
- UgandaMoES, (2006). *Revised ICT draft policy for information and communication technology in the education sector*. Kampala: Ministry of Education and Sports.

- Uganda MoES, (2008). *Revised education sector strategic plan 2007-2015*, Kampala: Ministry of Education and Sports.
- UN, (2018). *Building digital competencies to benefit from existing and emerging technologies, with a special focus on gender and youth dimensions*, Geneva: Commission on Science and Technology for Development.
- UNESCO, (2009). *Information and communication technologies*, Bonn: Retrieved 30 June 2016 from <http://www.unesco.org/es/higher-education/themes/education-building-blocks/teacher-education/icts/>.
- UNESCO, (2014). *Enhancing teacher education for bridging the education quality gap in Africa: Report on needs assessment framework of teacher training and development to ensure education for all*. Kampala: UNESCO.
- UNESCO, (2015). *Information and communication technology in education in Sub-Saharan Africa: A comparative analysis of basic e-readiness in schools*. Montreal: UNESCO.
- US National Center for Education Statistics, (2000). *Teachers' tools for the 21st Century: A report on teachers' use of technology*, Washington, DC: NCES 2000–102.
- van Dijk, J., (2005). *The deepening divide: Inequality in the information society*. Thousand Oaks: Sage.
- van Dijk, J., (2012). *The evolution of the digital divide: The digital divide turns to inequality of skills and Usage*. University of Twente: ISO Press.
- van Dijk, J. A. G. M., (2017). Digital divide: Impact of access. *The International Encyclopedia of Media Effects*, pp. 1-11.
- Wamakote, L., (2010). *National government investment in ICT initiatives in primary and secondary schools in East Africa*, East Africa: Centre for Commonwealth Education & Aga Khan University Institute for Educational Development – Eastern Africa Research Report No. 1.
- Wood, R. & Griffiths, M., (2007). Online data collection from gamblers: Methodological issues. *International Journal of Mental Health and Addiction*, vol. 5, pp. 151-163.
- Yin, R. K., (2014). *Case study research: design and methods*. London: Sage.

Appendix 3: Article III

Article III

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Teaching art and design in a digital age: challenges facing Ugandan teacher educators

Wycliff Edwin Tusiime ^a, Monica Johannesen^b and Greta Björk Gudmundsdottir^c

^aDepartment of Vocational Teacher Education, OsloMet – Oslo Metropolitan University, Oslo, Norway;

^bDepartment of Primary and Secondary Teacher Education, OsloMet – Oslo Metropolitan University, Oslo, Norway; ^cDepartment of Teacher Education and School Research, University of Oslo, Oslo, Norway

ABSTRACT

Although the use of digital technologies in teacher education has reached advanced stages in the developed world, it is still in its infancy in many developing countries, including Uganda. In their struggle to advance the use of digital technologies in teaching, educators face various challenges that prevent the successful adoption of such technologies in the classroom. This study explores the motivation and material accessibility challenges that art and design (A&D) educators in Uganda encounter when teaching with digital technologies and examines how they cope with these challenges. To address the research question, the study adopts a descriptive case study design that seeks to document the participants' accounts. Semi-structured interviews and non-participant observations were employed to collect data from teacher educators (TEs) and administrators (ADs) in two teacher training institutions (TTIs) in Uganda. The findings indicate that A&D TEs face accessibility challenges relating to motivation and material access. The educators use various strategies to cope with the existing challenges including peer support, continual practice, improvisation, lobbying for technical and financial support, and advocating for Bring Your Own Device (BYOD).

ARTICLE HISTORY

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KEYWORDS

Digital technologies; challenges; art and design; teacher education; Uganda

Introduction

Over the years, the use of digital technologies in teacher education has been considered vital for providing opportunities for educators and students to operate in an information society (Bingimlas 2009). Dawes (2001) argued that digital technologies can support education across the curriculum and provide opportunities for effective communication between teachers and students in ways that have not previously been possible. Habibu, Abdullah-Al-Mamun, and Clement (2012) added that teachers and students can use technologies for various purposes. However, Osborne and Hennessy (2003) observed that it is inappropriate to assume that the

CONTACT Monica Johannesen  monica.johannesen@oslomet.no

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use of digital technologies in the classroom will necessarily transform teacher education. In A&D education, which in the context of this study, we are concerned with the process of teaching and learning how to create and produce work in the visual arts such as sculpture, painting, graphic design, video making and performing arts such as music, dance and drama. Wilks, Cuthcer, and Wilks (2012) report that many art and design educators, even when they have embraced digital tools for artistic practice in the past, find that pedagogical use of digital technologies in the visual A&D classroom is somewhat more challenging. Many art educators are finding Information and Communication Technology (ICT) challenging to translate into meaningful and accomplished teaching and learning activities (Phelps and Maddison 2008). Although few studies address challenges that exist in specific subject areas in teacher education such as A&D in Uganda, British Educational Communications and Technology Agency (Becta) (2004) suggested that focusing on the challenges that affect practitioners in specific subject areas may be helpful. Schoepp (2005) added that addressing the challenges would improve the quality of teaching in specific subjects and enhance the use of technology in the classrooms. Thus, the present study explores the common challenges faced by teacher educators (TEs) in the field of A&D education guided by the following research question:

What motivational and material challenges do TEs encounter when teaching A&D with digital technologies and how do TEs cope with such challenges in Uganda?

The next section presents existing debates on the challenges TEs encounter when using digital technology in their classrooms.

Challenges in teaching with digital technologies

The use of digital technologies in teaching is a complex process and one that may encounter several challenges in both developed and developing countries. However, compared with developed countries, the use of technology in teacher education programmes in developing countries is relatively limited due to many challenges (Singhavi and Basargekar 2019; Passey et al. 2016). Studies over the last decade (Jamil, Jamil, and Bano 2015; Finger and Houguet 2009) have divided the challenges educators have faced into two main categories: *intrinsic* and *extrinsic* challenges. Intrinsic challenges relate to the individual teacher (teacher-level) and extrinsic challenges relate to the institution (administrative-level) (British Educational Communications and Technology Agency (Becta) 2003). The following sections discuss the existing literature related to the challenges based on the above categorisation.

Intrinsic challenges

First, the use of digital technologies in classrooms has received resistance from many educators for years because they view technology as an inconvenient

activity that is not aligned with their core teaching goals (Stoilescu 2014). In the field of A&D education, Wood (2004) asserted that teachers' traditional ideologies concerning the framework of aesthetics, and their beliefs and attitudes about the incompatibility between technology and art have been a setback to the adoption of digital technology. Hamisi (2019) concurred noting that teachers' values, negative attitudes and beliefs, human inertia and resistance to change play a significant role in influencing teachers' preparedness to embrace digital technology in their pedagogical practices. In developing countries like Uganda, Habibu, Abdullah-Al-Mamun, and Clement (2012) indicate that teachers' attitudes and their reluctance to accept new technology affected their use in the classroom and the likelihood of their benefiting from the training.

Second, previous studies in A&D education have indicated that educators feel that technology sometimes stifled student creativity or led to students replicating art instead of using traditional techniques (Black and Browning 2011; Loveless 2003). For instance, Loveless (2003) documented instances where some art educators were worried that technology could take away the creative ability of 'hands on' students with poor digital skills and who were uncomfortable with digital art making. By contrast, some educators noted that some students were too reliant on technology and did not want to draw.

Third, Wang (2002) reported continued reluctance among educators to embrace new technologies. While some resistance to integration might be attributable to age (Koksal 2013), Delacruz (2004) observed that most art educators use only basic applications (such as word processing) rather than applications designed to support creativity. Moreover, Wood's (2004) work highlighted that while some educators believe technology maintains student engagement and provides inspiration, others were concerned that students could be easily distracted by technology, thus avoiding its application in their pedagogical activities.

Fourth, studies have frequently cited lack of time as another challenge in the classroom integration of technology by educators (Kafyulilo, Fisser, and Voogt 2016). Educators in A&D claim that there is insufficient time to explore the medium and analyse artists who use this medium because of the myriad demands in this subject area (Phelps and Maddison 2008). Habibu, Abdullah-Al-Mamun, and Clement (2012) study revealed that although some educators in Uganda possess good skills in using technologies, they still make little use of technologies in the classroom because of insufficient time. Thus, educators whose schools give them time to develop their skills can be more creative than those who lack sufficient time.

Another intrinsic challenge is the TEs' lack of knowledge and digital competence required to integrate technology into pedagogical practice (Twebaze, Tesha, and Muturi 2019; Kihoza et al. 2016). In Syria, for example, teachers' lack of technological competence has been cited as the main challenge affecting teachers' confidence to use technology in teaching (Albirini 2006). Similarly, most educators in developing countries like Uganda are unable to use

technology in the classrooms because they did not receive sufficient pedagogical training in the use of digital technologies (Tusiime, Johannesen, and Gudmundsdottir 2019b). According to British Educational Communications and Technology Agency (Becta) (2004), successful teacher training should include pedagogical training, rather than simply training educators to use digital tools.

To summarise, intrinsic challenges of integrating digital tools in A&D education are rooted in both scepticism to the creativeness of using digital technology in A&D as well as lack of technological and pedagogical competence in using digital tools in education.

Extrinsic challenges

First, several educators identified inadequate access to digital resources as a major extrinsic challenge to the use of technology in the classroom (Judith, Alexandra, and Susan 2012). Although access to new technologies for TEs is widespread and differs from country to country, several studies (Tusiime, Johannesen, and Gudmundsdottir 2019b; Ghavifekr et al. 2016) have indicated that a lack of access to digital resources at school or home prevents educators in most parts of the developing world from using new technologies in their teaching. According to Light and Pierson (2013), teachers who have access to computers when they need them, wherever they need them are able to integrate more technology-based activities into their classrooms than those with less or no access.

Second, studies conducted in developing countries (Kafyulilo, Fisser, and Voogt 2016; Farrell and Isaacs 2007) indicate that poor infrastructure, unreliable electricity supply and overcrowded classrooms heavily constrain the adoption of digital technologies. In addition, the cost and strength of bandwidth is a universal constraint to internet use in teacher education. In the field of A&D education, Phelps and Maddison (2008) observed that A&D digital needs are specialised and more expensive than those of other academic subjects. Similarly, Aduwa-Ogiegbaen and Iyamu (2005) found that the cost of digital resources was a major impediment to the use of technology in Nigerian secondary schools.

Furthermore, studies (Mwakyusa and Mwalyagile 2016; Alemu 2015) reported inadequate technical support to maintain the digital equipment as a chronic problem discouraging educators from teaching with technology. As such, Sabaliauskas and Pukelis (2004) observed that educators have no intention to use technologies if they feel they will encounter technical problems that would take several days to repair. Korte and Hüsing (2007) concurred that technological support or maintenance contracts in schools help teachers to use digital technologies in teaching without losing time through having to fix software and hardware problems. Consequently, technical faults might discourage educators from using digital tools in their teaching because of the fear of equipment breaking down during a lesson.

To summarise, extrinsic challenges of integrating digital tools in A&D education relate to restricted access to technology, bad infrastructure and lack of maintenance of existing technology.

Coping with challenges in teaching with technology: strategies by educators

To cope with intrinsic challenges and support the learning, educators use collaborative strategies (e.g. teamwork and peer-peer mentoring), physical visual-aids and a variety of activities for continual practice and learning through examples and videos (Sentance and Csizmadia 2017). Additionally, Johnson et al. (2016) suggested that teachers require training with a focus on constructivism, student-centred learning and the pedagogical use of technology that should emphasise the intersection of technological knowledge, pedagogical knowledge and content knowledge (TPACK) advanced by Mishra and Koehler (2006).

To counteract extrinsic challenges such as inadequate digital technologies, Carter (2017) and Afreen (2014) suggested that schools or educators move towards a 'bring your own device' (BYOD) strategy in which students bring their own digital devices to class to use for educational purposes instead of relying on devices provided by the school.

In addition, Johnson et al. (2016) mentioned that educators can employ the following five strategies in their practice to combat the challenges they encounter when teaching with technology in the classroom: (1) apply for funds (e.g. crowdfunding, grants) to support digital infrastructure and improve access in schools, (2) seek guidance from professional bodies to identify effective professional development programmes; (3) exploit the expertise of master educators in professional learning communities; (4) request training on newly adopted digital software directly from software companies; and (5) ensure that adequate technical, administrative and peer support is available to educators during the integration of technology in the classroom.

From this literature review, we conclude that digital tools are often used as tools for supporting creativity and visualisation in teaching. However, there is a substantial scepticism to the role of such digital tools in the creative process. Insufficient access and infrastructure make the teaching unpredictable. To cope with these challenges, educators adapt collaborative as well as individual coping strategies.

Theoretical framework

This study uses perspectives from resources and appropriation theory (RAT) (van Dijk 2005) to address the research question. The core argument of van Dijk's RAT is that categorical inequalities in society produce an unequal distribution of resources and that an unequal distribution of resources causes unequal access to digital resources such as computers and the internet (van Dijk 2005). At the

core of RAT are the types of access to digital technology. Accordingly, van Dijk (2005, 21) addressed four kinds of 'access' to digital technologies: 'motivational access (motivation to use digital technology), material or physical access (possession of computers and internet connections or permission to use them and their contents), skills access (possession of digital skills: operational, informational and strategic skills) and usage access (number and diversity of applications, usage time)'. To address the research question, we focus on motivation and material access in relation to intrinsic and extrinsic factors which influence the use of digital technology in teacher education. The ensuing sub-sections discuss this relationship further. Even though skills and usage access are important and could be relevant to this study, van Dijk (2017) indicates that having physical access to digital technologies and being motivated are key components for the effective use of technology. Thus, we will only explore two particular concepts of the model (motivational and material access), without focusing on the successive nature of the RAT model. The other concepts of the theory are applied in (Tusiime, Johannesen, and Gudmundsdottir 2019a, 2019b).

One of the strengths of the RAT theory is how it views the different kinds of access in a successive way. This can also be viewed as one of the challenges of the theory, as these concepts are quite interrelated and sometimes overlapping. Although van Dijk's theory has often been used for studying the digital divide, it is also subject to critique (Mariën et al. 2016; Brandtzaeg, Heim, and Karahasanovic 2011). For instance, Mariën et al. (2016) have questioned whether the consecutive nature of the model continues to be valid today, given the ongoing and relentless digitisation of society and to whether individuals are still first to be motivated to use digital technologies.

Motivational access

According to van Dijk (2005), to appropriate a new technology, one must first be motivated to use it. van Dijk (2005) related motivational access to attitude and the intention of potential users to adopt, acquire and learn the requisite skills to use new digital technologies. He added that lack of motivation is not limited to reluctance; it is also present in adopters who rarely use new media (van Dijk 2005). As such, some people are not intense seekers of information and do not like or are not attracted to digital technologies. van Dijk (2017) maintained that motivational access is often affected by intrinsic factors relating to social, cultural or psychological factors or to particular resources people have or lack, including interest, time, money, skills, anxiety, self-confidence and technophobia. Thus, sufficient motivation influences one's decisions to purchase digital tools, to learn the requisite skills and to use digital technologies (van Dijk 2005). van Dijk (2017) also argued that people with a lack of motivation to gain access to digital technologies should not be accused of being backward, but rather the current flaws of technology should be highlighted; these include the lack of

user-friendliness, affordability and safety (van Dijk 2005). When a technology is experienced to be expensive and multifaceted (multimedia) and the cause of accessibility and usability problems, this will increase access problems in general (van Dijk 2012).

Material access

van Dijk (2005) argued that having material or physical access is a necessary condition for the development of the requisite skills and ability to use technology. He describes material access as the possession of or access to hardware, operational software, the internet or other digital technologies as well as permission to use them (e.g. user names, passwords and membership). Statistics have revealed large differences in physical access to digital technologies among parts of the population and among different countries; for example, developing countries still have limited access at work and schools and a predominance of access in public places (van Dijk 2005). Physical access to digital technology is influenced by both intrinsic and extrinsic factors such as one's income, level of education, employment status, geographical location, age and gender. Similarly, van Deursen and van Dijk (2019) noted three important aspects (all dependent on technical characteristics) relating to material access inequalities: (1) differences in device opportunities; (2) differences in the diversity of devices and peripherals; and (3) differences in the maintenance costs of devices and peripherals.

Furthermore, van Deursen and van Dijk (2019) suggested that the challenges associated with motivational and material access can be mitigated by deliberate policies for the training of employees and for educational improvements at all levels. Indeed, van Dijk (2005) identified a number of policy strategies to mitigate the challenges to both motivational and material access. For instance, to improve motivational access, van Dijk suggests the need to (1) increase the surplus value of digital technologies, (2) increase the usability and user-friendliness of new technologies, (3) organise information campaigns to promote useful applications of technologies, and (4) produce and promote services for underserved groups through funding. Conversely, van Dijk (2005) suggested the need to increase access to basic technologies, create broadband access, giving subsidies to groups lagging behind; create public access points; and connect schools and other public institutions.

In summary, we use the above theoretical concepts relating to motivation and material access to present and discuss the findings.

Methods

The study adopts a descriptive case study design (Yin 2014) to explore the challenges TEs encounter in teaching A&D with digital technologies and to

examine how they cope with such challenges. A case study design is preferred because it allows an in-depth description of a case or multiple cases, which provides a rich amount of qualitative data from each participant for a deeper understanding into the phenomena under investigation. An in-depth case study design is also justifiable for research involving small sample sizes (Isaac and Michael 1997), as in this study.

Purposive sampling was chosen to select 14 appropriate participants that would yield insights into the problem under investigation rather than empirical generalisations. The participants included 10 TEs and four ADs from two teacher training institutions (TTIs), Kabwohe and Sheema (pseudonyms), in central Uganda. Although this study focuses on TEs' experiences relating to the research question, the ADs' opinions were included because they are key stakeholders in the provision of the required teaching resources such as digital technologies and the formulation of policies that guide their use in TTIs in Uganda. For clarity, in this study, TEs are qualified persons who instruct prospective and practising teachers at different levels of teacher professional development. In the Ugandan context, these may include lecturers, tutors, instructors, technicians and studio or laboratory attendants at different levels of teacher education. By contrast, ADs are responsible for overseeing the daily teaching or managerial operations in the TTIs and thereby have knowledge relevant to the research question.

In this study, semi-structured interviews and non-participant observations were used to explore the views, experiences, beliefs and motivations of individual participants in relation to the research question. This combination of methods provided reliable and comparable data. Interviews were conducted with the individual participants at their convenience and lasted one hour on average, allowing sufficient time to explore the deeper meaning of participants' views before reaching saturation point (Glenna 2008). In addition, two TEs who had been previously interviewed from each institution were observed engaging in classroom practice to assess the challenges they (TEs) faced as they interacted with digital tools in the classrooms. The observations were also done to identify discrepancies between data sources or events that participants might be reluctant to share (Kawulich 2005) and to observe situations the participants had described during the interviews. The interviews were audio-recorded and transcribed with the other data obtained from observations (such as field notes and comments made during the observations). Each classroom observation lasted about one hour and was guided by the observation checklist, which focused on identifying the challenges TEs encountered in technology-rich classrooms during the teaching process.

In this study, the transcribed data were organised in tables created in Microsoft Word based on specific questions in the interview guide. This layout made it easier to perform a first-level analysis that identified frequently occurring words and phrases in the data. These words were colour-coded, and similar codes were later clustered to define empirical categories. A second-level

analysis was performed based on the theoretical concepts described in the previous section to select the findings presented in this paper.

Although qualitative methods such as interviews and observations can yield rich and informative data, they are criticised for their subjectivity, which may compromise the validity and reliability of the data collected. To avoid subjectivity, first, the interview data were cross-referenced with data from the observations to check for any inconsistencies. Second, for triangulation purposes and to ensure the quality of the study findings, data from the observations were subsequently used to supplement the interview findings. Third, to further increase the validity of the data, immediate feedback was received from each informant after reading through and approving his or her transcribed interview or observation reports. In addition, data collection instruments (i.e. interview guide and observation checklist) were piloted with a group of experts in the area of this research who provided feedback on the clarity of the items with reference to the research question to ensure quality of data.

Furthermore, to protect the identity of institutions and participants in this study, pseudonyms (i.e. Kabwohe and Sheema – for institutions) and codes for instance, TE#1, TE#2 ... (for findings in the next section). Last, research clearance was granted by the following research bodies: Mildmay Uganda Research Ethics Committee (MUREC), the Uganda National Council for Science and Technology (UNCST) and the Norwegian Centre for Research Data (NSD).

Findings and discussion

The findings from interview and observational data in this study are discussed under the following themes: motivational access, material access and coping strategies. Further, the discussion of findings is based on van Dijk's (2005) theoretical framework and in view of the literature presented in the previous sections.

Motivational access

The data obtained from the interviews and observations indicate that TEs encountered a number of motivational challenges. First, several TEs reported *negative attitudes* as a challenge educators face when teaching A&D with digital technologies in Uganda's TTIs. As such, some of the educators avoided using digital technologies when teaching in A&D classrooms. Regarding the issue of negative attitude among individual TEs and students, TE#5 said the following:

The traditional attitude is held by some teachers wanting to sustain their way of teaching. Such teachers [...] resist using digital tools because they possess negative attitudes towards their benefits in teaching and learning.

Similarly, both ADs interviewed at Kabwohe agreed that the negative attitude of teachers was a major challenge hindering technology use in the classroom. One

administrator added that some of the educators avoided participating in training meant to improve their digital skills to use technology due to negative attitudes. Similarly, AD#1 interviewed at Kabwohe reported,

There is this kind of attitude or desire for teachers to stay in their comfort zone. [...] You find that very few are willing to learn how to effectively or even practically use the technologies or platforms that are available. [...] Some teachers think they are past the age of getting to use some of these ICT tools.

However, although the TEs at both institutions and ADs at Kabwohe reported teachers' negative attitudes, the ADs at Sheema agreed that the majority of teachers' had positive attitudes towards technology use. For instance, AD#4 stated the following:

Basically I have seen almost everybody has a positive attitude towards the use of ICT now. Tutors prepare their teaching plans, use the internet to search for content, teach using computers, prepare lesson plans and content on computers and print them out for submission and they use the system very well, with the exception of very few tutors.

Although TEs were highly motivated to encourage their students to use the latest hardware, software and the internet in the production of the A&D works, the classroom observations at both institutions revealed that educators were less engaged in giving a physical demonstration of how such technologies can be used to achieve the desired learning outcomes. Specifically, educators placed little emphasis on showing students how to attain their learning goals.

Whereas Habibu, Abdullah-Al-Mamun, and Clement (2012) indicated teachers' negative attitudes towards technology integration in Uganda, the present findings show that there is a gap between teachers' expressed attitude and teachers' actual practice. There is a certain tension to be found in the self-reported interview data where our informants were quite optimistic and positive towards the use of digital technologies in their teaching and the actual observations in the field. The observations showed the coping strategies teachers used in terms of various accesses. van Dijk (2005) posited that sufficient motivation influences one's attitude and decisions to purchase digital tools, learn the requisite skills and to use digital technologies. Even though some educators reported negative attitudes and limited usage of the technologies was observed in the A&D classrooms, the teachers however claim they encourage their students to use digital technologies. Given the intrinsic and extrinsic factors relating to social, cultural, mental or particular resources people have or lack (van Dijk 2017), educators' attitudes towards full-time practical engagement with available technologies in the classroom are negative, even though they simultaneously express the importance of using digital technologies to their students.

Second, some TEs reported a *lack of self-confidence* in using digital technologies as a motivational challenge they face in Uganda's TTIs. More than half the number of TEs interviewed reported that educators at the TTIs lacked self-

confidence because of *inadequate digital competence*. TE#4 underpinned this finding:

As a teacher, my confidence to use digital tools becomes low in situations where some of my students are more digitally competent. In such a scenario, I am reluctant to teach using digital tools because I do not know how to use WhatsApp or another software application which the students know very well.

The above finding is supported by ADs at both institutions who reported that the majority of the TEs did not possess the requisite digital competence suitable for pedagogical purposes. For instance, AD#2 reported that ‘a lack of competence from key facilitators [TEs] to use digital tools greatly deters them from ably sharing their knowledge’. Similarly, AD#4 noted that inadequate digital competence makes teachers lose interest in teaching with technology in their classrooms.

In addition, it was noted on several occasions that individual TEs rarely engaged in hands-on demonstrations with available technologies (hardware and software) in the classroom. Even when student teachers were more interested in using the technology, there was less practical guidance from TEs during the teaching. Student teachers were often observed actively working together in groups on shared laptops and helping each other to work on activities that required the use of digital tools with minimal or no guidance from educators.

In relation to the above findings, previous studies in developing countries (Kihiza et al. 2016; Tusiime, Johannesen, and Gudmundsdottir 2019b) have also found that teachers’ lack of digital skills influences their confidence to use technologies when teaching. van Dijk (2017) noted that motivational access is often affected by factors people have or lack, including skills, self-confidence and technophobia. Thus, van Dijk (2017) observed that users with relevant digital skills could use digital resources to achieve particular goals in different career contexts such as education. In regard to the present study, although TEs were motivated to use available technologies, this motivation was hindered by inadequate digital competences that later affects TEs self-confidence to use available technologies.

Third, a large number of TEs reported a *lack of time* allocated for them and for students to use digital technologies during the A&D lessons. Some TEs added that owing to the large number of students per classroom, it was not practical to attend to all the students and thus they have, on several occasions, attempted to teach only the theoretical concepts of technology in the available time. The following statement from TE#2 confirms TEs’ sentiments regarding this challenge:

There is no time for both teachers and students to teach, practice or do their personal work with digital tools. The institution runs too many programmes [subjects] on the teaching timetable. The new curriculum stretches both teachers and students. We teach past 5 pm but if we stopped earlier, students would have more time to practice and teachers to plan. [...] We have a chance for capacity building in teaching with

technologies but usually what happens is that the time given for training is short and someone is forced to learn too much in a short time.

By contrast, some ADs noted that TEs failed to dedicate enough time to engage in both training and actual use of technology in teaching. AD#4 reported that 'there is not enough time; one cannot teach properly with technology'. From the classroom observations, although TEs at Kabwohe had, on average, three hours allocated for each of the technology-related A&D lessons, their counterparts at Sheema had a maximum of one hour for the same lessons. In both situations, the TEs indicated that the allocated time was not enough to prepare and teach practically using technology in the classroom because of challenges such as electricity cut-offs inadequate digital skills and poor digital infrastructure.

Phelps and Maddison (2008) previously identified time as a constraining factor and advised that visual A&D teachers require sufficient time if they are to improve their digital competence and effectively integrate technologies in the classrooms. Likewise, van Dijk (2005) added that precise usage time is a valid indicator that can determine the users' digital skills and motivation level. Indeed, A&D TEs need sufficient time allocated to demonstrate the available technology to the students when teaching in their classrooms. Doing so is more likely to improve TEs' digital skills and raise their confidence to integrate digital technologies in the A&D classrooms.

Notably, several TEs reported *fear for loss of creativity* as another challenge deterring them from integrating digital technologies in the teaching of A&D. They claimed that digital technologies like computer applications help both teachers and students to plagiarise other people's content. Some of the educators noted that this act hampers an A&D student's ability to think creatively. TE#4 stated the following:

When [I] give students an assignment [in my class], they will just copy and paste from the internet [and] that has caused a lot of problems especially for my class. I think teachers are also doing that; they are copying information from the internet and using it without contacting resources or getting authorisation.

Equally, during the classroom observations at Kabwohe, students were observed using content (mainly images) downloaded from the internet in their artworks without permission from the authors. Such images were manipulated using Adobe Photoshop and other design software for use in the students' artworks. It was also observed that some A&D student teachers showed resistance to concept development, a core part of creativity. For instance, in one of the classroom observations, some students did not want to start by creating hand-drawn sketches as was guided by the educator but rather questioned the educator about why they could not start designing directly on their computers using the design software. Thus, the students seemed not to have understood why it was necessary to create hand-drawn sketches before advancing to the computer.

Therefore, even though the issue of creativity is paramount in the field of A&D education, the above data suggest that TEs are unable to ensure that the originality of a students' creative mind is upheld in students' digital artworks. Instead, previous studies in A&D education (Black and Browning 2011; Loveless 2003) have indicated that educators feel that technology often stifled student creativity or resulted in replication of art. Owing to inadequate digital knowledge and skills reported in this study, A&D TEs cannot fully help their students to creatively use technology to create innovations.

Material access

Regarding material access, both TEs and ADs reported a *lack of adequate access to digital technologies* (i.e. hardware, software and Internet) as a fundamental challenge to teaching A&D with digital technologies at both institutions. While some TEs indicated that there was no open access to the internet in any of the classrooms, computer labs, staff rooms or other locations within their institutions, several other TEs reported the inadequacy of both the technology used in teaching A&D subjects. For that reason, some TEs reported having purchased or used personal equipment, and others mentioned having had access in public places like internet cafes or borrowing from colleagues. TE#3 described the situation as follows:

We do not have enough digital resources at this institution. Each of our classes is over 60 students. In this room, there are 15 computers and the other room has 20. Having so many students on one computer limits individual students' access, and some will just be onlookers, doze off or distract others. [...] We want something to be done, but we are limited by the resources.

Similarly, although basic hardware tools (mainly computers) were seen in the computer laboratories at both institutions during the classroom observations, the available technologies are not commensurate with the large number of students in the classes. It was further observed that even among the available digital resources, they did not work due to *technological failures* and some had few or no professional A&D software applications installed.

Notably, the lack of adequate access to digital technologies at both institutions could hinder their use in the teaching of A&D. Even though access to digital technologies may not be the only sufficient condition for technology use (van Dijk 2005), the lack of access found in this study is likely to impede the successful integration of technology in the teaching of A&D subjects. Moreover, recent studies in Uganda (Twebaze, Tesha, and Muturi 2019; Tusiime, Johannesen, and Gudmundsdottir 2019b) indicate that the lack of adequate digital resources reduced the use of digital technologies in the A&D classrooms. By contrast, Light and Pierson (2013) posited that educators who are able to access technologies whenever and wherever they need them can integrate

more technology-based activities into their classrooms than those with less or no access.

Equally important, several participants (both TEs and ADs) at both institutions mentioned *unreliable electricity supply* to be a major challenge to using the available digital technologies. The interview data obtained from the TEs and ADs confirmed that an unreliable power supply greatly hinders the use of technologies at both TTIs. Some TEs revealed that power fluctuations sometimes lead to damages of digital equipment and make it difficult for educators to teach effectively with technologies.

Further, although the ADs confirmed the existence of power backups such as standby generators and solar panels at both institutions, they added that technical breakdowns de-motivate and sometimes prevent the educators from using digital technologies in the teaching process. Additionally, several TEs also expressed their dissatisfaction with the persistent *lack of adequate technical personnel* to rectify the technical breakdowns.

The observations also highlighted that access to reliable electricity was a general problem at both institutions that urgently needed to be confronted. At Kabwohe, for instance, even when electricity was available, educators could not find it in the classrooms or computer laboratories. There were no or limited power supply points (sockets) in the classrooms where educators and students could charge their computers or other digital devices before or during the A&D lessons. Therefore, even though some educators are prepared to use digital technology, it would not be possible or they would spend more time charging the equipment before the teaching commenced. Previous studies conducted in some developing countries in Africa (Kafyulilo, Fisser, and Voogt 2016; Farrell and Isaacs 2007) have indicated that unreliable electricity supply in classrooms especially in rural schools heavily constrains the adoption of digital technologies. Efforts are therefore needed to ensure the availability of steady electricity supply in the classrooms and laboratories as this could encourage educators to use the available technologies in the A&D classrooms.

Coping strategies

During the interviews, the participants were asked about how they cope with the challenges encountered when teaching A&D with digital technologies identified in the previous sections. Regarding the motivational challenges, the TEs reported to have coped mainly through *encouragement*, *peer-peer support* and *continual practice* with digital tools to acquire basic digital skills. Through encouragement and help from their peers, some TEs reported to gain increased motivation and developed positive attitudes and basic competence to use digital technologies. Furthermore, some educators reported to have *participated in training* on the use of technology to improve their digital competences.

However, a few TEs reported to have avoided teaching with digital technologies in A&D classrooms. TE#2 reported the following in relation to coping with motivational challenges:

[We] just keep talking and encouraging [each other]. In addition, sometimes you just continue [practicing], it is a personal initiative and if you get interested you move alone. [...] Giving [students] more activities for practice and we engage [in] peer-to-peer support.

Additionally, the ADs put several institutional strategies in place to ensure that educators cope with the motivational challenges they face when teaching A&D with digital technologies. Such strategies included encouraging educators and supporting them through continuous training to develop their capacity in technology use.

Our findings show that TEs mainly depend on support from each other through collaborative practices to mitigate the challenges encountered when teaching A&D with digital technologies. The TTIs seem only to encourage educators to persist amidst the challenges instead of addressing the motivational challenges by, for example, increasing educators' ability to use digital technologies for pedagogical purposes. Previous studies (Sentance and Csizmadia 2017; Johnson et al. 2016) have reported positive results relating to the use of collaborative strategies to address some of the motivational challenges to technology use. However, Tusiime, Johannesen, and Gudmundsdottir (2019a) findings revealed that collaboration with persons who possess digital competence is of utmost importance.

The TEs also reported to having coped with challenges relating to material access through improvisation, advocating for BYOD and lobbying for more digital tools through institutional budgets and external funding. In relation to these findings, TE#1 stated the following:

Sometimes we improvise [...] through acquiring equipment that can serve ideally related purpose for instance in cases of lack of a recorder, one could improvise with a phone. The other way is to buy the digital tool(s) [...] through requisition in the institutional budget until you get what you want. Actually that's how we have managed to get what we have.

According to TE#7 and TE#8, during power blackouts, which are common at both institutions, standby generators are set to run on rare occasions. However, both educators reported to have prepared backups (e.g. hard copies) of their digital teaching content to share with students during instruction when power outages occur. Additionally, some TEs reported to have sometimes procured or used personal technology in situations where the institutions experienced blackouts.

In addition, the ADs reported that their institutions supported educators to cope with the challenges relating to material access through lobbying for more technical and financial support, recruitment of part-time ICT instructors, partnerships with different stakeholders such as parents, developing agencies and

ministry of education to develop ICT infrastructure and the provision of standby generators and solar panels to mitigate the problem of power blackouts. In relation to the strategies by the institution to curb the challenges encountered by TEs, AD#4 at Sheema stated that,

Payments by students have enabled us to improve the internet and repair computers or printers when they break down.

Although some of the strategies reported by participants partly resonate with what previous studies (Afreen 2014; Carter 2017) in different contexts have highlighted, it is still difficult to implement them fully in practice at both institutions. For instance, participants expressed frustration that most of the students did not adhere to the BYOD and that the government sometimes failed or took too long to meet the institutions' budgetary requisitions for additional digital infrastructure. van Deursen and van Dijk (2019) suggested that the challenges associated with motivational and material access can be mitigated by deliberate policies for educational improvements at all levels. Additionally, van Dijk (2005) identified several policy strategies to mitigate the challenges to both motivational and material access. Conversely, such policies geared at increasing both motivational and material access to basic technologies in schools and public institutions (van Dijk 2005) could be adopted by TTIs in Uganda to improve the use of technologies in the teaching of A&D subjects.

Implications and conclusion

This study explores the motivational and material challenges TEs encounter when teaching A&D with digital technologies and how TEs cope with such challenges in Uganda. By using van Dijk's resources and appropriation theory we have illustrated in what ways motivational and material access play a significant role when integrating digital technology in A&D education. In this study, the employment of the RAT theory has been used in terms of scrutinising two particular concepts of the model (motivational and material access), without focusing on the successive nature of the concepts in van Dijk's original model. This has shown to be useful to understand the dimensions of motivational and material access. At the same time, this particular way of using RAT has illustrated that the successiveness of the model is not necessarily linear, but rather interconnected. For example, is it difficult to explain motivational access without considering both material access and skills access. In that sense, this study suggests that the employment of the RAT theory should be less bound to the successive stages and more on the interconnected nature of it.

The findings indicate that A&D TEs face motivational challenges (linked to negative attitude, lack of self-confidence, lack of time, inadequate digital competence and fear for loss of creativity). It is noteworthy to see the diverse attitudes between self-reported data on motivation and teachers' actual use from the classroom observations. Although some TEs express negative attitude towards the use

of technology, others align with the idea of using technology in education. Yet, when observing the TEs in the classroom, challenges regarding material access seem to overshadow the intentions of being a part of a digitalised society. The challenges related to material access revealed in this study are typical for countries that dedicate less means to invest in what is necessary for robust technological infrastructure (e.g. lack of adequate access to digital technologies, unreliable electricity supply, technological failures and lack of adequate technical support). Thus, access to technological infrastructure varies. In an ideal situation, both access to relevant digital tools and internet connection is in place. However, in practice, the reality is often different. This does not only apply to Ugandan context but is also the case in more affluent countries such as Norway (Hatlevik and Gudmundsdottir 2013). Lack of proper technological infrastructure can further influence not only opportunities to use and motivation to use but also attitudes and the general digital competence of teachers.

This study indicates that A&D educators have used alternative strategies such as peer support, continual practice, improvisation, lobbying for technical and financial support, and advocating for BYOD to cope with the existing challenges. These coping strategies, such as the fact that TEs need to use personal equipment like private cell phones to access digital material and the internet, may indicate that there is a lack of clear institutional policy and implementation plan of digital tools in the A&D education programmes in this study. Furthermore, use of personal equipment to weight up for limited institutional access can be seen as reinforcing existing societal inequalities and unequal distributions of resources. Moreover, the findings imply that Ugandan TEs do not get the desired opportunities to use digital technologies in A&D classrooms but are well aware of its relevance. As such, the potential of digital technology is not fully utilised due to existing challenges reported in this study.

There is an urgent need to address the digital divide that currently exists through the identified accessibility challenges in Ugandan TTIs to improve the teaching of A&D with digital technologies. This could be done through renewed ICT education policy focus and strategic implementation plans at both the institutional and national levels.

The limitation of this study is that it only explored the accessibility challenges encountered by A&D TEs and how TEs and TTIs in Uganda mitigated these challenges. We suggest that further research should seek to identify other challenges encountered by other stakeholders such as the students, TTIs and the government. Further, to investigate how such challenges could be mitigated when adopting digital technologies in A&D classrooms in Uganda.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Wycliff Edwin Tusiime  <http://orcid.org/0000-0001-6746-8909>

References

- Aduwa-Ogiegbaen, S., and E. Iyamu. 2005. "Using Information and Communication Technology in Secondary Schools in Nigeria: Problems and Prospects." *Educational Technology & Society* 18 (1): 104–112.
- Afreen, R. 2014. "Bring Your Own Device (BYOD) in Higher Education: Opportunities and Challenges." *International Journal of Emerging Trends & Technology in Computer Science* 3 (1): 233–236.
- Albirini, A. 2006. "Teachers' Attitudes toward Information and Communication Technologies: The Case of Syrian EFL Teachers." *Computers & Education* 47 (4): 373–398. doi:10.1016/j.compedu.2004.10.013.
- Alemu, B. M. 2015. "Integrating ICT into Teaching-Learning Practices: Promise, Challenges and Future Directions of Higher Educational Institutes." *Universal Journal of Educational Research* 3 (3): 170–189. doi:10.13189/ujer.2015.030303.
- Bingimlas, K. A. 2009. "Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of the Literature." *Eurasia Journal of Mathematics, Science and Technology Education* 5 (3): 235–245. doi:10.12973/ejmste/75275.
- Black, J., and K. Browning. 2011. "Creativity in Digital Art Education Teaching Practices." *Art Education* 64 (5): 19–34. doi:10.1080/00043125.2011.11519140.
- Brandtzaeg, P. B., J. Heim, and A. Karahasanovic. 2011. "Understanding the New Digital Divide – A Typology of Internet Users in Europe." *International Journal of Human-computer Studies* 69 (3): 123–138. doi:10.1016/j.ijhcs.2010.11.004.
- British Educational Communications and Technology Agency (Becta). 2003. *What the Research Says about Barriers to the Use of ICT in Teaching*. https://mirandanet.ac.uk/wp-content/uploads/2019/06/wtrs_11_ict_teaching.pdf
- British Educational Communications and Technology Agency (Becta). 2004. *A Review of the Research Literature on Barriers to the Uptake of ICT by Teachers*. https://dera.ioe.ac.uk/1603/1/becta_2004_barrierstouptake_litrev.pdf
- Carter, J. 2017. "Expanding Access to Learning." *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education* 6 (2): 49–54.
- Dawes, L. 2001. "What Stops Teachers Using New Technology?" In *Issues in Teaching Using ICT*, edited by M. Leask, 61–79. London: Routledge.
- Delacruz, E. 2004. "Teachers' Working Conditions and the Unmet Promise of Technology." *Studies in Art Education* 46 (1): 6–20. doi:10.1080/00393541.2004.11650065.
- Farrell, G., and S. Isaacs. 2007. *Survey of ICT and Education in Africa: A Summary Report Based on 53 Country Surveys*. Washington, DC: InfoDev/World Bank.
- Finger, G., and B. Houguet. 2009. "Insights into the Intrinsic and Extrinsic Challenges for Implementing Technology Education: Case Studies of Queensland Teachers." *International Journal of Technology and Design Education* 19 (3): 309–334. doi:10.1007/s10798-007-9044-2.
- Ghavifekr, S., T. Kunjappan, L. Ramasamy, and A. Anthony. 2016. "Teaching and Learning with ICT Tools: Issues and Challenges from Teachers' Perceptions." *Malaysian Online Journal of Educational Technology* 4 (2): 38–57.
- Glenna, B. O. 2008. "Naturalistic Inquiry and the Saturation Concept: A Research Note." *Qualitative Research* 8 (1): 137–152. doi:10.1177/1468794107085301.

- Habibu, T., M. Abdullah-Al-Mamun, and C. Clement. 2012. "Difficulties Faced by Teachers in Using ICT in Teaching-Learning at Technical and Higher Educational Institutions of Uganda." *International Journal of Engineering Research & Technology (IJERT)* 1 (7): 1–9.
- Hamisi, M. 2019. "Awareness and Use of a Mobile Phone as a Potential Pedagogical Tool among Secondary School Teachers in Tanzania." *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)* 15 (2): 154–170.
- Hatlevik, O. E., and G. B. Gudmundsdottir. 2013. "An Emerging Digital Divide in Urban School Children's Information Literacy: Challenging Equity in the Norwegian School System" *First Monday*, Volume 18, Number 4-1, April 2013. <https://firstmonday.org/ojs/index.php/fm/article/download/4232/3641>
- Isaac, S., and W. B. Michael. 1997. *Handbook in Research and Evaluation: A Collection of Principles, Methods, and Strategies Useful in the Planning, Design, and Evaluation of Studies in Education and the Behavioral Sciences*. 3rd ed. San Diego: Educational and Industrial Testing Services.
- Jamil, M., S. Jamil, and S. Bano. 2015. "Extrinsic and Intrinsic Barriers of Integrating ICTs Tools in Teaching at Undergraduate and Elementary Level: A Comparative Study." *Pakistan Journal of Social Sciences (PJSS)* 36 (2): 1073–1087.
- Johnson, A. M., M. E. Jacovina, D. G. Russell, and C. M. Soto. 2016. "Challenges and Solutions When Using Technologies in the Classroom." In *In Adaptive Educational Technologies for Literacy Instruction*, edited by S. A. Crossley and D. S. McNamara, 13–29. New York: Taylor & Francis.
- Judith, W., C. Alexandra, and W. Susan. 2012. "Digital Technology in the Visual Arts Classroom: An [un]Easy Partnership." *Studies in Art Education: A Journal of Issues and Research in Art Education* 54 (1): 54–65.
- Kafyulilo, A., P. Fisser, and J. Voogt. 2016. "Factors Affecting Teachers' Continuation of Technology Use in Teaching." *Education and Information Technologies* 21 (6): 1535–1554. doi:10.1007/s10639-015-9398-0.
- Kawulich, B. B. 2005. "Participant Observation as a Data Collection Method [81 Paragraphs]." *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* 6 (2). Art.43. <http://nbn-resolving.de/urn:nbn:de:0114-fqs0502430>.
- Kihoza, P., I. Zlotnikova, J. Bada, and K. Kalegele. 2016. "Classroom ICT Integration in Tanzania: Opportunities and Challenges from the Perspectives of TPACK and SAMR Models." *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)* 12 (1): 107–128.
- Koksal, H. 2013. *Reducing Teacher Resistance to Change and Innovations*. London, England: Prepared address, Kingston University.
- Korte, W. B., and T. Hüsing. 2007. "Benchmarking Access and Use of ICT in European Schools 2006: Results from Head Teacher and A Classroom Teacher Surveys in 27 European Countries." *eLearning Papers* 2 (1): 1–6.
- Light, D., and E. Pierson. 2013. "The Impact of School Technology Infrastructure on Teachers' Technology Integration: A Survey in Thirteen Countries." *Ubiquitous Learning: An International Journal* 5 (4): 29–40. doi:10.18848/1835-9795/CGP/v05i04/40376.
- Loveless, A. 2003. "Making a Difference? An Evaluation of Professional Knowledge and Pedagogy in Art and ICT." *Journal of Art and Design Education* 22 (2): 145–154. doi:10.1111/1468-5949.00350.
- Mariën, I., R. Heyman, K. Salemink, and L. Van Audenhove. 2016. "Digital by Default: Consequences, Casualties and Coping Strategies." In *Digital Margins: How Spatially and Socially Marginalized Communities Deal with Digital Exclusion*, edited by K. Salemink, 51–76. Groningen: University of Groningen.

- Mishra, P., and M. J. Koehler. 2006. "Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge." *Teachers College Record, Columbia University* 108 (6): 1017–1054. doi:10.1111/j.1467-9620.2006.00684.x.
- Mwakyusa, W. P., and N. V. Mwalyagile. 2016. "Impediments of E-Learning Adoption in Higher Learning Institutions of Tanzania: An Empirical Review." *Journal of Education and Practice* 7 (30): 152–160.
- Osborne, J., and S. Hennessy. 2003. *Literature Review in Science Education and the Role of ICT: Promise, Problems and Future Directions*. London: Future Lab.
- Passey, D., T. Laferrière, M. Y-A. Ahmad, M. Bhowmik, D. Gross, J. Price, P. Resta and M. Shonfeld. 2016. "Educational Digital Technologies in Developing Countries Challenge Third Party Providers." *Educational Technology & Society* 19 (3): 121–133.
- Phelps, R., and C. Maddison. 2008. "ICT in the Secondary Visual Arts Classroom: A Study of Teachers' Values, Attitudes and Beliefs." *Australasian Journal of Educational Technology* 24 (1): 1–14. doi:10.14742/ajet.1226.
- Sabaliauskas, T., and K. Pukelis. 2004. "Barriers to Integration of Information and Communication Technologies into the Teaching and Learning Process." Paper presented at the European Conference on Educational Research, University of Crete, Heraklion 700 13, Greece, September 22- 25.
- Schoepp, K. 2005. "Barriers to Technology Integration in a Technology-Rich Environment." *Learning and Teaching in Higher Education: Gulf Perspectives* 2 (1): 1–24.
- Sentance, S., and A. Csizmadia. 2017. "Computing in the Curriculum: Challenges and Strategies from a Teacher's Perspective." *Education and Information Technologies* 22 (2): 469–495. doi:10.1007/s10639-016-9482-0.
- Singhavi, C., and P. Basargekar. 2019. "Barriers Perceived by Teachers for Use of Information and Communication Technology (ICT) in the Classroom in Maharashtra, India." *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)* 15 (2): 62–78.
- Stoilescu, D. 2014. *Studying Challenges in Integrating Technology in Secondary Mathematics with Technology Pedagogical and Content Knowledge (TPACK)*. New South Wales, Australia: University of Western Sydney.
- Tusiime, W. E., M. Johannesen, and G. B. Gudmundsdottir. 2019a. "Developing Teachers' Digital Competence: Approaches for Art and Design Teacher Educators in Uganda." *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)* 15 (1): 133–147.
- Tusiime, W. E., M. Johannesen, and G. B. Gudmundsdottir. 2019b. "The Dilemma of Teaching with Digital Technologies in Developing Countries: Experiences of Art and Design Teacher Educators in Uganda." *Nordic Journal of Comparative and International Education (NJCIE)* 3 (2): 55–71. doi:10.7577/njcie.3313.
- Twebaze, C. B., J. M. Tesha, and K. Muturi. 2019. "Investigation on the Poor Computer Graphic Design Skills among Art and Design Students at University." *International Journal of Humanities Social Sciences and Education (IJHSSE)* 6 (10): 61–71.
- van Deursen, A. J. A. M., and J. A. G. M. van Dijk. 2019. "The First-level Digital Divide Shifts from Inequalities in Physical Access to Inequalities in Material Access." *New Media & Society* 21 (2): 354–375. doi:10.1177/1461444818797082.
- van Dijk, J. A. G. M. 2005. *The Deepening Divide: Inequality in the Information Society*. Thousand Oaks: Sage.
- van Dijk, J. A. G. M. 2012. "The Evolution of the Digital Divide: The Digital Divide Turns to Inequality of Skills and Usage." In *Digital Enlightenment Yearbook 2012*, edited by Bus, J., M. Crompton, M. Hildebrandt and G. Metakides, 57–75. Amsterdam: IOS Press.

- van Dijk, J. A. G. M. 2017. "Digital Divide: Impact of Access." In *The International Encyclopedia of Media Effects*, edited by R. Patrick, 1–11. United Kingdom: JohnWiley & Sons
- Wang, L. 2002. "How Teachers Use Computers in Instructional Practice: Four Examples in American Schools." *Journal of Art and Design Education* 21 (2): 154–163. doi:10.1111/1468-5949.00310.
- Wilks, J., A. Cuthcer, and S. Wilks. 2012. "Digital Technology in the Visual Arts Classroom: An [Un] easy Partnership." *Studies in Art Education* 54 (1): 54–65. doi:10.1080/00393541.2012.11518879.
- Wood, J. 2004. "Open Minds and a Sense of Adventure: How Teachers of Art & Design Approach Technology." *International Journal of Art & Design Education* 23 (2): 179–191. doi:10.1111/j.1476-8070.2004.00396.x.
- Yin, R. K. 2014. *Case Study Research: Design and Methods*. London: Sage.

Appendix 4: Interview guide for TEs and TTs

Background information

Participant Number:

Code:

Gender:

Teaching Experience:

Period of teaching with digital tools:

Area of specialization/Subject:

Institution:

Date of Interview:

Time and Duration of Interview:

Interview Questions

RQ1: In what ways are teacher educators using digital technology when teaching art and design in Uganda?

1. (a) What kind of digital tools are available in your institution?
(b) Which of the available digital tools do you use in the teaching of your subject?
(c) How do you access digital tools for teaching in this institution?
(d) Apart from your institution, where else do you access digital tools for teaching?
2. How often do you use digital tools (*e.g. internet, software programs, video, computers, digital cameras, printers, scanners, projectors e.t.c*) in your classroom teaching? (*always, sometimes, daily, occasional, or not at all*)
3. Why do you use digital tools in teaching of your subject?
4. In your opinion, how do you judge your competence in using digital tools to plan, teach and evaluate learners and why? (*poor, moderate, good, and excellent*)
5. How do you use digital tools in the teaching process (i.e. planning, actual teaching, evaluation)?
6. What opportunities (if any) do you encounter in teaching with digital tools?
7. How do such opportunities enhance teaching in your subject?
8. What components of digital technology are integrated in the institution's Art and Design teaching curriculum?
9. How do digital tools-supported lessons differ from traditional modes of delivery (without digital support) in your area of teaching?
10. How do you ensure ethical use of digital tools in the teaching process?

RQ2: How do art and design teacher educators develop their digital competence in Teacher Training Institutions in Uganda?

11. Did you attain any training (formal/informal) to develop competence in the use of digital tools to teach art and design? Explain how this training was conducted and the specific competences you acquired?
12. Apart from the formal training, are there other approaches through which you develop competence to use a range of digital tools in teaching your subject area?
13. What strategies do you propose towards the improvement of teachers' digital competence in your teaching field?

RQ3: What challenges do teacher educators encounter when teaching art and design with digital technology in Uganda?

14. What challenges do you face in in the process of teaching your subject (Art & Design) with digital tools?
15. How do such challenges affect the teaching processes in your subject?
16. How do you cope with such challenges in the process of teaching with digital tools?

Appendix 5: Interview guide for Administrators (ADs)

Background information

Participant No. :
 Code :
 Name :
 Gender :
 Position held at institution :
 Date of Interview :
 Time and Duration of Interview :

Interview Questions

RQ1: In what ways are teacher educators using digital technology when teaching art and design in Uganda?

1. What kind of digital tools (if any) are available in your institution for teachers to use in the teaching?
2. How do teachers access digital tools (computers, internet, e.t.c.) for pedagogical use in this institution?
3. What opportunities do teachers encounter in the process of teaching with digital technology?
4. How do such opportunities related to ICT use affect the teaching process?
5. How do you ensure that teachers to make use of the available digital tools for pedagogical purposes in the institution?
6. Does your institution have a policy on the pedagogical use of ICT? How does it influence (if at all) the use of digital tools in the teaching processes?
7. In which ways (if any) does the curriculum provide for the pedagogical use of digital tools in this institution?
8. What are teacher's attitudes towards the use of digital tools in the teaching process in your institution?

RQ2: How do art and design teacher educators develop their digital competence in Teacher Training Institutions in Uganda?

9. Reflect on your teacher's competence to use digital tools in the teaching process? (what is lacking/missing and what are the strengths)
10. How does teachers' level of digital competence affect the teaching in your institution?
11. How do teachers acquire competences to use digital tools for pedagogical purposes in this institution?
12. What strategies (if any) does your institution have in place to ensure that teachers continuously develop their digital competences?

RQ3: What challenges do teacher educators encounter when teaching art and design with digital technology in Uganda?

13. What challenges do teachers encounter in the process of teaching with digital tools in your institution / department? (*technological, pedagogical, content, motivation, access, skills*)
14. How do such challenges related to ICT use affect the teaching process?
15. What strategies has the institution put in place to address the challenges encountered by teachers in technology-rich classrooms?

Appendix 6: Observation Guide

Classroom Observation Guide (Adopted and revised from the TPACK observation checklist)

Institution Department.....
 Class observed..... Date.....
 Lesson duration..... Observer.....
 Teacher: Topic/sub-topic

No.	Items	Observations				comments
		1	2	3	4	
	PART 1: Classroom Composition					
1.	Number of students.					
2.	Number of Males.					
3.	Number of Females.					
4.	Special needs (specify).					
5.	Special needs facilities.					
6.	Classroom environment (workshop / lecture room / computer lab, other)					
	PART 2: The Technological, Pedagogical and Content Knowledge (TPACK) question					
7.	<i>Technology Knowledge (TK)</i>					
	The teacher has essential digital tools for the lesson					
	The teacher uses technology to support instructional strategies					
	The teacher uses digital tools without any problems					
8.	<i>Content Knowledge (CK)</i>					
	The teacher exhibits a good mastery of subject matter knowledge.					
	The teachers presents relevant and accurate facts in relation to the topic					
	The teacher provides a variety of references for the students to gain relevant content in the subject taught.					
	The teacher reinforce the topic lesson by providing assignments to students					
9.	<i>Pedagogical Knowledge (PK)</i>					
	The teacher knows essential pedagogical approaches for the lesson preparation and presentation (direct instruction, collaborative learning, problem based learning, e.t.c..)					
	The teacher demonstrates an understanding of different styles of student learning					
	The teacher structures the lesson to promote student learning					
10.	<i>Technological Content Knowledge (TCK)</i>					
	The teacher uses technology to demonstrate complex ideas that would otherwise be difficult to learn.					
	The teacher uses technology to allow students to observe things that would otherwise be difficult to be observed by naked eyes					
	All teaching aids including digital graphics are attractive (size and colours) and support the theme/content of the lesson.					
	The teacher helps students to use technology to investigate and construct meaning of the complex ideas they are learning					
11.	<i>Technological Pedagogical Knowledge (TPK)</i>					
	The teacher teaches a lesson appropriately combining subject content, technologies and teaching & learning					

	approaches.					
	The teacher uses technology to support student learning approaches for the lesson taught					
	The teacher uses technology to support learners' collaboration during the learning process.					
	The teacher is well prepared (having lesson plan) and able to manipulate technology to present a relevant lesson contents					
12.	<i>Technological Pedagogical and Content Knowledge (TPACK)</i>					
	The teacher teaches a lesson that appropriately combines subject content, technologies and teaching & learning approaches.					
	The teacher uses technology to support student learning approaches for the lesson taught					
	The teacher uses technology to support learners' collaboration during the learning process					
	The teacher is well prepared (having lesson plan) and able to manipulate technology to present a relevant lesson contents					
	PART 3: Teaching and Learning Activity					
13.	<i>Teacher pedagogical approaches that were used in the delivery of the lesson</i>					
	Leading (includes lecturing, directing class activities)					
	Facilitating/assisting students					
	Class control (includes discipline management)					
	Other approaches (specify under comment)					
14.	<i>How the teacher used digital technology in the delivery of the lesson</i>					
	Technology use was not evident					
	To present information					
	For visualization or modeling of a concept					
	To present a student task					
	For grading, attendance or material preparation					
	Other (specify under comments)					
15.	<i>Student response and participation in the lesson – Active or Passive?</i>					
	What is the teacher and students are doing. How are they interacting in the lesson activity?					
	What are the students and teachers doing that they could not have done without technology? (Benefits / opportunities of digital technology)					
	Description of student work in the activity observed. Any evidence to showcase teachers' use of technology to produce assignment resources.					
	PART 4: TPACK Lesson plan					
16.	<i>Does the lesson plan exhibit an appropriate selection of technology to support lesson delivery?</i>					
	Technology selections are exemplary, given curriculum goals and instructional strategies.					
	There is sufficient description of how technology will be used in the classroom					
	Technology choice is relevant to the context and learning needs of the students.					
17.	<i>Can you identify appropriate pedagogical approaches to support lesson delivery</i>					
	The pedagogical approaches are well identified in the lesson.					
	The designed lesson provide more activities for students to carry out than for the teacher to carry out					

	Constructivists teaching approaches (problems based learning, inquiry learning e.t.c) are proposed in the lesson.					
18.	<i>How has technology been used to enhance delivery of content as stated in the lesson plan?</i>					
	The technology chosen is aligned with one or more curriculum goals.					
	There is a clear link between the use of technology and the content					
	Teacher explains in the lesson plan how a specific technology will be used to change the content of the topic he/she teachers.					
	Teacher has chosen a technology that enhances a content of a lesson he/she teaches					
19.	<i>How has the teacher demonstrated technology use to enhance delivery of content as stated in the lesson plan (TCK)?</i>					
	The technology chosen is aligned with one or more curriculum goals.					
	There is a clear link between the use of technology and the content					
	Teacher explains in the lesson plan how a specific technology will be used to change the content of the topic he/she teaches					
	Teacher has chosen a technology that enhances a content of a lesson he/she teaches					
20.	<i>What evidence is there of teacher demonstration of Technological Pedagogical Knowledge (TPK) in the lesson plan?</i>					
	Teacher chooses an appropriate technology in relation to the teaching approaches he/she adopts in the class.					
	The technology chosen supports instructional strategies					
	The choice of technology is relevant to the kind of activities proposed in the lesson.					
	The technology identification is-in line with the instructional goals					
21.	<i>Is there evidence of Technological Pedagogical and Content Knowledge (TPACK) in the lesson plan?</i>					
	The lesson plan distinguishes the students' and teachers activities and the role of technology during the classroom session.					
	The lesson plan clearly describe the technology the content and the pedagogy to be used during the learning					
	The lesson plan provides a clear link between TK, PK, and CK					

Key

- 1 - Not Observed
- 2 - Approaching Expectations
- 3 - Meeting Expectations
- 4 - Exceeding Expectations

Appendix 7: Approval to conduct research at Kabwohe TTI

October 19, 2017


TO WHOM IT MAY CONCERN

RE; PERMISSION TO CONDUCT RESEARCH IN THE DEPARTMENT OF ART AND INDUSTRIAL DESIGN

Permission is hereby granted to Wycliff Edwin Tusiime to conduct an academic research in the department of Art and Industrial Design under the title "*Teachers' digital Competence in the Teaching of Art and Design in Teaching Training Institutions in Uganda*" He is a PhD student at Oslo and Akershus University College of Applied Sciences, Norway.

He is expected to observe ethical values while interacting with respondents.

Sincerely



Wycliff Edwin Tusiime

HOD Art and Ind. Design



Appendix 8: Approval to conduct a research study at Sheema TTI

Our Ref:.....	
Your Ref:.....	13 th March, 2017 Date:.....
To;	
Wycliff Edwin Tusiime PhD Candidate Oslo & Akershus University College of Applied Sciences Faculty of Education & International Studies Department of Vocational Teacher Education P.B. 4, St. Olavs Plass 0130 Oslo, Norway	
Dear Tusiime,	
RE: PERMISSION TO CONDUCT A PhD RESEARCH AT : PTC	
Reference is hereby made to your letter dated 13 th March 2017 requesting for permission to conduct a PhD research project at Shimoni Core PTC titled " <i>Teachers' Digital Competence in the Teaching of Art and Design in Teacher Training Institutions in Uganda</i> ". I therefore inform you that permission has been granted.	
You will be attached to the Department of Integrated Production Skills (IPS) where Art and Design is offered. In this department, you will be provided with appropriate guidance on the resources you require to enable you successfully carryout your research.	
During the research period, you are required to respect the college culture, programmes and norms. You are requested to keep the information collected from participants and other members of the college community confidential and only for academic purposes.	
The College wishes you good deliberations as you carry out your research.	
Yours sincerely,	
	
Deputy Principal, Pre-service	
	

College Motto: Nos Et Mutamur

Mission: To provide & Support Quality Education for Teachers Children and Community

Appendix 9: Approval from Research Ethics Committee



Research Ethics Committee (MUREC)

15 May 2018

Wycliff Edwin Tusiime
Kyambogo University,
Faculty of Vocational Studies,
Department of Art & Industrial Design,

Dear Wycliff:

Re: Initial approval of your Research protocol: #REC REF 0703-2018 "Teachers digital competence in the teaching of art and design in Teacher training institutions in Uganda."

Thank you for submitting an application for approval of the above referenced protocol to MUREC.

I am glad to inform you that approval is hereby given to conduct the study; this approval is given following your exhaustive responses to initial comments raised by MUREC. This approval is for one year, effective 14th May 2018 and will expire on 14th May 2019. Extension beyond this expiry date and changes to the protocol including data collection tools must be brought to the attention of MUREC.

However, before you proceed you are required to submit the protocol to Uganda National Council for Science and Technology (UNCST) for registration.

You are also required to provide progress reports at an annual interval, to notify Mildmay Uganda Research Committee on completion, as well as when publishing results.

Please do not hesitate to contact us if you have any questions.

I wish you success in this endeavor.

Yours Sincerely,

Harriet Chemusto
Chairperson,
Mildmay Uganda Research Ethics Committee (MUREC)



Location/ Correspondence
Mildmay Uganda
Plot 27, Lweza
P.O.Box 24985, Kampala

Communication
Tel: 0392174236
Email: murec@mildmay.or.ug
WWW.mildmay.org/uganda

Guiding Research For the Future

Appendix 10: UNCST Approval letter



Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

Dear WYCLIFF TUSIIME,

I am pleased to inform you that on **13/06/2018**, the Uganda National Council for Science and Technology (UNCST) approved your study titled, **Teachers digital competence in the Teaching of Art and Design in Teacher Training Institutions in Uganda**. The Approval is valid for the period of **13/06/2018 to 13/06/2021**.

Your study reference number is **SS152ES**. Please, cite this number in all your future correspondences with UNCST in respect of the above study.

Please, note that as Principal Investigator, you are responsible for:

1. Keeping all co-investigators informed about the status of the study.
2. Submitting any changes, amendments, and addenda to the study protocol or the consent form, where applicable, to the designated local Research Ethics Committee (REC) or Lead Agency, where applicable, for re-review and approval prior to the activation of the changes.
3. Notifying UNCST about the REC or lead agency approved changes, where applicable, within five working days.
4. For clinical trials, reporting all serious adverse events promptly to the designated local REC for review with copies to the National Drug Authority.
5. Promptly reporting any unanticipated problems involving risks to study subjects/participants to the UNCST.
6. Providing any new information which could change the risk/benefit ratio of the study to the UNCST for review.
7. Submitting annual progress reports electronically to UNCST. Failure to do so may result in termination of the research project.

Please, note that this approval includes all study related tools submitted as part of the application.

Yours sincerely,

Musa Kwehangana

For: Executive Secretary

UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Appendix 11: NSD Approval to conduct research



Wycliff Edwin Tusiime
 Institutt for yrkesfaglærerutdanning Høgskolen i Oslo og Akershus
 Postboks 4 St. Olavs plass
 0130 OSLO

Vår dato: 19.01.2017

Vår ref: 51524 / 3 / STM

Deres dato:

Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 10.12.2016. Meldingen gjelder prosjektet:

51524	<i>Teachers' Digital Competence in the Teaching of Art and Design in Teacher Training Institutions, Uganda</i>
<i>Behandlingsansvarlig</i>	<i>Høgskolen i Oslo og Akershus, ved institusjonens øverste leder</i>
<i>Daglig ansvarlig</i>	<i>Wycliff Edwin Tusiime</i>

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, <http://www.nsd.uib.no/personvern/meldeplikt/skjema.html>. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, <http://pvo.nsd.no/prosjekt>.

Personvernombudet vil ved prosjektets avslutning, 31.08.2019, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Kjersti Haugstvedt

Siri Tenden Myklebust

Kontaktperson: Siri Tenden Myklebust tlf: 55 58 22 68

Vedlegg: Prosjektvurdering

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

NSD – Norsk senter for forskningsdata AS Harald Hårfagres gate 29 Tel: +47-55 58 21 17 nsd@nsd.no Org.nr. 985 321 884
 NSD – Norwegian Centre for Research Data NO-5007 Bergen, NORWAY Faks: +47-55 58 96 50 www.nsd.no

Personvernombudet for forskning



Prosjektvurdering - Kommentar

Prosjektnr: 51524

The Data Protection Official presupposes that the project is carried out in accordance with legislation in Uganda.

The sample will receive written information about the project, and give their consent to participate. The letter of information is well formulated, but we ask that the following is added:

-That Oslo and Akershus University College is responsible for the study

-Your name and contact information

The data material is gathered through interviews and observation. If you plan to make use of video and audio recordings during participant observation, we presuppose that all participants have received information about the project and given their explicit consent to this.

In the notification form, you state that you may include persons with impaired consent capacity. Inclusion of persons with reduced consent capacity should only be done in those instances where it is impossible to conduct the research on persons with consent capacity. Based on the project information we cannot find that it is necessary or relevant to include persons with impaired consent capacity, and therefore the inclusion of persons with impaired consent is not covered by our recommendation. If you plan to recruit persons with impaired consent capacity, we ask that you send more information to personvernombudet@nsd.no before contact with the sample is established.

The Data Protection Official presupposes that the researcher follows internal routines of Oslo and Akershus University College regarding data security. If personal data is to be stored on portable storage devices, the information should be adequately encrypted.

Estimated end date of the project is 31.08.2019. According to the notification form all collected data will be made anonymous by this date. Making the data anonymous entails processing it in such a way that no individuals can be recognised. This is done by:

- deleting all direct personal data (such as names/lists of reference numbers)
- deleting/rewriting indirectly identifiable data (i.e. an identifying combination of background variables, such as residence/work place, age and gender)
- deleting digital audio and video files

Appendix 12: Introductory Letter from HiOA / OsloMet



To whom it may concern

Date: 11. November 2016

Our ref.: ref. Executive officer: Aleksandra Weder Sawicka
Your ref.: ref.

Confirmation

Wycliff Edwin Tusiime is a PhD candidate enrolled in the PhD Programme in Educational Sciences for Teacher Education (180 ECTS), at Faculty of Education and International Studies, Oslo and Akershus University College of Applied Sciences, Norway. He enrolled on 1st of September 2016, for a period of 3 years.

He is conducting his research in Uganda under the theme: *Enhancing Art and Design Teacher's Capacity to use ICT in Vocational Training Institutions in Uganda.*

Any assistance rendered to him is highly appreciated.

If you have any questions, please do not hesitate to contact us at phd-lui@hioa.no.

Yours sincerely,

Aleksandra Weder Sawicka
Senior Adviser

Appendix 13: Participant Information Sheet

Participant Information Sheet

*Please take some time to read this information and ask questions if anything is unclear.
Additional contact details can be found at the end of this document.*

Project title: *Teachers' Digital Competence in the Teaching of Art and Design in Teacher Training Institutions in Uganda*

Sponsor: *Kyambogo University, NORHED-MVP Project*

Principal Investigator: *Wycliff Edwin Tusiime*
Doctoral Student, Faculty of Education and International Studies
Oslo & Akershus University College of Applied Sciences, Norway

Contact details: Tel: *+256703064621*
Email: *wycliffdux@yahoo.com*

Background and purpose of the research

There is a lot of evidence from studies conducted in Uganda that although teachers' use of digital tools is considered critical in the education sector, teachers often fail to demonstrate the ability to use even the available digital resources available in the classrooms. With specific reference to Art and Design education, though some teachers have basic knowledge on the use of digital tools as an instructional tool, majority do not possess hands-on digital pedagogical skills. There are hardly any studies in Uganda to address the need to develop teachers digital competences for pedagogical purposes in the field of art and design teacher education.

The main purpose of this PhD research project is to examine teachers' digital competence in the teaching of Art and Design in Teacher Training Institutions (TTIs) in Uganda. Specifically, the research will address the following questions (i) *In what ways are teachers using or not using digital tools in the teaching of art and design?*; (ii) *What challenges and/or opportunities do teachers meet in the use of digital tools during teaching processes in Art and Design?*; (iii) *In what ways can teachers develop digital competence to enrich the teaching of art and design in TTIs?*

What does participation in the project imply?

Primary data will be collected from participants (who will include teachers, teacher trainees and administrators) through semi-structured face-to-face interviews, and non-participant observations. Approximately 30 participants in the field of art and design teacher education will be engaged in this research. Using semi-structured interview guides, interviews will be conducted with individual participants at selected Teacher Training Institutions (TTI) in Uganda. The interview questions will directly seek to answer the three research questions presented earlier in the above section and data collected will be captured mainly in the form of note taking and audio recordings. The interview will last for one to one-and-a-half hours. Before any information is collected, each participant consent is required to participate in this project.

Do I have to take part in this research project?

Though it is in the interest of this project to have the purposely selected samples to participate, any participant can at any time choose to withdraw his/her consent to participate without stating any reason. Participation in this project is voluntary and you may ask the researcher questions before agreeing to participate. In case a participant decides to withdraw, all their personal data will be deleted.



What will happen to the information about you?

All personal data will be treated confidentially and used only for academic purposes. The PhD candidate will only publish information with which the participant has authorized. All personal data collected in form of notes, audio recordings and photographs will be safely stored on a personal computer protected with password and all information regarding identities of participants and institutions from where data will be collected will be kept anonymous to ensure confidentiality. No participant or institution will be recognizable in the publication. The project is scheduled for completion by 31.08.2019 and all information will be eradicated after the project period is over.

What are the possible benefits of participating?

There is no direct benefit for you in this study but the information you will share will greatly contribute to knowledge on teachers' use of digital tools in the teaching of art and design in Uganda.

What are the possible risks of taking part?

No risks are anticipated for your participation in this study. However, in the event that anything make you uncomfortable at any time during the interview or observation, you can choose to withdraw.

What should I do if I have any concerns or complaints?

If you have any concerns or complaints about the project, please contact the researcher, who should acknowledge your concerns and give you a wayforward on how your concern will be addressed. If your concern(s) or question(s) is/are not addressed, please contact *Monica Johannsen, Main Research Supervisor. Tel +47 67237112, email: monica.johannesen@hioa.no.*

Ethical approval and Getting answers to questions about your rights as a research participant:

The study has been notified to the Data Protection Official for Research, NSD - Norwegian Centre for Research Data (nsd@nsd.no). The NSD reviewed this study to ensure that your rights and welfare are protected and that this study is carried out in an ethical manner. This study has also been approved by a Ugandan Research Ethics Committee and the Uganda National Council for Science and Technology (UNCST).

For questions about your rights as a research participant, contact:

Norwegian Centre for Research Data (NSD)
Contact person
Siri TendenMyklebust
Tel: +4755582268

Please refer to the following number when contacting the above contact person: **51524**

OR

Mildmay Uganda Research Ethics Committee (MUREC)

By mail:

Harriet Chemusto
Mildmay Uganda
Kuddukiro House, Research Ethics Office
P.O. BOX 24985 Kampala (U)
Tel: 0392174236
Email: murec@mildmay.or.ug

Thank you for reading this information sheet and for considering taking part in this research.

Faculty of Education and International Studies

Postal address: Pb. 4 St. Olavs plass, 0130 OSLO

Visiting address: Pilestredet 52, 0350 Oslo, Phone: 22452016, postmottak@hioa.no, www.hioa.no



Appendix 14: Informed Consent Form

Form Version: 3/12/2018

KEY INFORMANT INFORMED CONSENT FORM

Study title: **Teachers' Digital Competence in the Teaching of Art and Design in Teacher Training Institutions in Uganda.**

Sponsor: **Kyambogo University, NORHED-MVP Project**

Principal Investigator: **Wycliff Edwin Tusiime**

Telephone: **+256703064621**

Description of the research project

The main purpose of this PhD research project is to examine teachers' digital competence in the teaching of Art and Design in Teacher Training Institutions (TTIs) in Uganda. Specifically, the research will address the following questions (i) *In what ways are teachers using or not using digital tools in the teaching of art and design?*; (ii) *What challenges and/or opportunities do teachers meet in the use of digital tools during teaching processes in Art and Design?*; (iii) *In what ways can teachers develop digital competence to enrich the teaching of art and design in TTIs?*

Primary data will be collected from participants (who will include teachers, teacher trainees and administrators) through semi-structured face-to-face interviews, and non-participant observations. The study plans to enroll up to 30 participants. Using semi-structured interview guides, interviews will be conducted with individual participants at selected Teacher Training Institutions (TTI). The interview questions will directly seek to answer the three research questions presented earlier in this consent letter and data collected will be captured mainly in the form of note taking and audio recordings. Before any information is collected, your consent is required to participate in this study.

Please take a few minutes to read through the following additional information relating to your rights as a participant during the research process and how the information you share will be used:

- Your participation in this research is voluntary and you can withdraw at any time without penalty or giving reason.
- The interview will last for one to one-and-a-half hours (1 hour to 1½ hours)
- The entire interview session will be audio recorded for report writing and analysis of the data. Only the research team will have access to the recording.
- Your participation and the information you share will be kept private and no identifiable information will be shared with anyone outside the research team. All personal data will be treated confidentially and used only for academic purposes. The Principal Investigator / PhD candidate will only publish information with which the participant has authorized.
- All personal data collected in form of notes, audio recordings and photographs will be safely stored on a personal computer protected with password and all information regarding identities of participants and institutions from where data will be collected will be kept anonymous to ensure confidentiality. No participant or institution will be recognizable in the publication or reports.



Form Version: 3/12/2018

- While quotes maybe used, your name will not be used in any reports or articles. Instead, pseudonyms will be used in all the writings or reports.
- You may choose not to answer any question that makes you feel uncomfortable.
- No risks are anticipated for your participation in this study
- There is no direct benefit for you in this study but the information you will share will greatly contribute to knowledge on teachers' use of digital tools in the teaching of art and design in Uganda.
- You will receive feedback on the outcome(s) of this research project
- You will not be paid for taking part in this study but you will receive a bottle of drinking water and a snack during the interview.
- You will not be charged any cost for participating in this study.
- Any questions you have about this study will be answered before and after the interview. For additional questions that may arise after your participation, the contact information is provided below in this consent letter. You will retain a signed copy of this letter.
- The project is scheduled for completion by 31.08.2019. All information will be eradicated after the project period is over.

Contact information

If you would like to participate or if you have any questions concerning this research project, please contact: **Monica Johannsen, supervisor. Tel +47 67237112, email: monica.johannesen@hioa.no** or the **Principal Investigator, Wycliff Edwin Tusiime, Tel +256703064621, email: wycliffdux@yahoo.com**

Getting answers to questions about your rights as a research participant:

The study has been notified to the Data Protection Official for Research, NSD - Norwegian Centre for Research Data (nsd@nsd.no). The NSD reviewed this study to ensure that your rights and welfare are protected and that this study is carried out in an ethical manner. This study has also been approved by a Ugandan Research Ethics Committee and the Uganda National Council for Science and Technology (UNCST).

For questions about your rights as a research participant, contact:

Norwegian Centre for Research Data (NSD)
 Contact person
 Siri Tenden Myklebust
 Tel: +4755582268

Please refer to the following number when contacting the above contact person: **51524**

OR

Mildmay Uganda Research Ethics Committee (MUREC)

By mail:

Harriet Chemusto
 Mildmay Uganda
 Kuddukiro House, Research Ethics Office
 P.O. BOX 24985 Kampala (U)
 Tel: 0392174236
 Email: murec@mildmay.or.ug



Form Version: 3/12/2018

Consent for participation in a research study

I have read and understood the above information about the project "*Teachers' Digital Competence in the Teaching of Art and Design in Teacher Training Institutions, Uganda*". By signing and dating this document, I am willing to participate.

Participant

Print Name:.....

Date:.....

Sign Name:.....

Principal Investigator/ PhD Candidate

Print Name:.....

Date:.....

Sign Name:.....



Appendix 15: Participant Consent to photograph and/or videotape

Form Version: 5/10/2018

Participant Consent to Photograph and/or Videotape

I am 18 years of age or older and hereby grant the researcher designated below from *Oslo and Akershus University College of Applied Sciences in Norway* permission to photograph and/or videotape my voice and likeness. The researcher is only permitted to use my voice and likeness in photograph(s)/video for research activities related to the study titled «*Teachers digital competence in the teaching of art and design in Teacher training institutions in Uganda*» approved by a recognized Research Ethics Committee. My name will not be used in any publication. I will make no monetary or other claim against the researcher for the use of the photograph(s)/video.

Name:

Signature:

Date:

RESEARCHER

Name: **Wycliff Edwin Tusiime**

Address and Contact Information: **Kyambogo University, Faculty of Vocational Studies. P.O. BOX 1, Kyambogo. Tel: +256703064621; email: wycliffdux@yahoo.com**

Signature:

Date:



Appendix 16: A Call for Research Participants

Date: 13th March 2017

From: Wycliff Edwin Tusiime
PhD candidate
Oslo & Akershus University College of Applied Sciences
Faculty of Education & International Studies
Department of Vocational Teacher Education

To: Art and Design Lecturers/Tutors
& Students

Dear Lecturers and Students,

Request for Participation in Research Project

I am **Wycliff Edwin Tusiime**, a PhD student at Oslo and Akershus University College of Applied Sciences, Norway conducting a study on;

“Teachers’ Digital Competence in the Teaching of Art and Design in Teacher Training Institutions, Uganda”

Project description

The main goal of this PhD research project is to examine teachers’ digital competence in the teaching of Art and Design in Teacher Training Institutions (TTIs) in Uganda. To achieve this goal, data will be collected from individual participants through face-face interviews, and some participants will be observed during classroom practice. Each interview conducted will last for approximately 45 minutes to 1 hour.

Why it is important to participate in this project?

- Your participation will provide vital information required to address the following key questions in this project:
RQ1: In what ways are teacher educators using digital technology when teaching art and design in Uganda?
RQ2: How do art and design teacher educators develop their digital competence in Teacher Training Institutions in Uganda?
RQ3: What challenges do teacher educators encounter when teaching art and design with digital technology in Uganda?
- The findings from this research project will greatly contribute to knowledge on teachers’ use of digital tools in the teaching of art and design in Uganda and improve the practice.

If you would like to participate or if you have any questions concerning the project, please contact; **Wycliff Edwin Tusiime; PhD Candidate.**

Via
SMS / Phone call: +256703064621 / 0778947496
WhatsApp: +256778947496
Email: wycliffdux@yahoo.com
Facebook: *Wycliff Tusiime*

Thank you very much for your cooperation!