



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

Wycliff Edwin Tusiime, Monica Johannesen & Greta Björk Gudmundsdottir

To cite this article: Wycliff Edwin Tusiime, Monica Johannesen & Greta Björk Gudmundsdottir (2020): Teaching art and design in a digital age: challenges facing Ugandan teacher educators, Journal of Vocational Education & Training, DOI: [10.1080/13636820.2020.1786439](https://doi.org/10.1080/13636820.2020.1786439)

To link to this article: <https://doi.org/10.1080/13636820.2020.1786439>



© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 26 Jun 2020.



[Submit your article to this journal](#)



Article views: 1629



[View related articles](#)



[View Crossmark data](#)

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

Wycliff Edwin Tusiime <sup>a</sup>, Monica Johannesen<sup>b</sup> and Greta Björk Gudmundsdóttir<sup>c</sup>

<sup>a</sup>Department of Vocational Teacher Education, OsloMet – Oslo Metropolitan University, Oslo, Norway;

<sup>b</sup>Department of Primary and Secondary Teacher Education, OsloMet – Oslo Metropolitan University, Oslo, Norway; <sup>c</sup>Department 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

Received 13 December 2019

Accepted 18 June 2020

### 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](mailto:monica.johannesen@oslomet.no)

© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

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](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](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 *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. Saleminck, 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. Saleminck, 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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1111/j.1476-8070.2004.00396.x).
- Yin, R. K. 2014. *Case Study Research: Design and Methods*. London: Sage.