Digitalisation of education in East Africa: Needs, experiences and opportunities for the future

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Contents

Key take-aways

In this study, we investigated the current situation, needs, and opportunities for digitalisation of tertiary education (TVET and University) in East Africa. We specifically looked into **the experiences of teachers and policy staff working at tertiary education institutions** in Tanzania, Ethiopia, Kenya, and Uganda.

In short, we can conclude that:

- **Digitalisation is a high policy priority** at a majority of the teachers' and policy staff institutions in all four countries. COVID-19 increased the urgency to digitise education resources and processes. However, the current practice of digitalisation is **mostly at a basic level.**
- The **quality of infrastructure is limited, resulting in unequal access** to reliable and affordable internet and computer equipment, especially among students. Moreover, teachers and students often **lack the necessary digital skills** to be able to use the available technology effectively.
- Teachers and policy staff reported that the **added value of digitalisation is mostly to improve the quality of education and stimulate knowledge exchange and collaboration**. Digitalisation can make education more accessible, better connected with the labour market, and more competitive. However, the **potential risks of digitalisation should be kept in mind**, especially with regard to security, improper use of technology, and (increasing) inequality.
- **Cooperation between European and East African educational institutions** could contribute to the further digitalisation of tertiary education in Africa. At the same time, our results show that there are **important requirements** in order for such cooperation to be successful and sustainable.

Future initiatives that aim to support digitalisation in East Africa should consider the following:

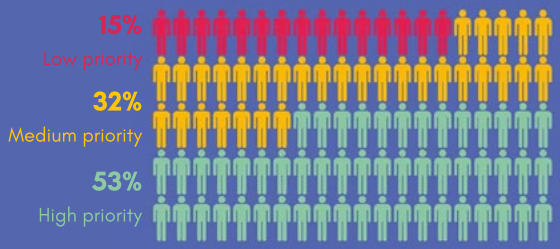
1. **Digitalise with a purpose - Focus on the learning goals**. In order for digitalisation to increase the quality of education, it is essential to let the learning goals inform which digital tools to use.
2. **Ensure inclusive learning - Close the gap in educational opportunities.** Digitalisation initiatives that focus on disadvantaged students and rural and vocational education will lead to the biggest effect in terms of providing more equitable opportunities.
3. **Take an integral approach - Build infrastructure, digital skills, and awareness**. Each of these factors cannot succeed without the other and should be built simultaneously.
4. **Meet teachers where they are at - Enhance teacher engagement.** Teachers are the key figures in delivering digital education. Initiatives supporting digitalisation should build on existing local initiatives and teachers' experiences.
5. **Utilise partnerships: leverage shared challenges and goals**. When collaborating internationally, ensure transparency on how each partner will benefit from the partnership. Also explore intra-African partnerships and public-private partnerships.

If you have any questions about the report, please do not hesitate to contact us at skommers@nuffic.nl

Visual summary of the survey results

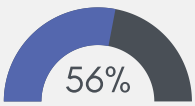
DIGITALISATION OF TERTIARY EDUCATION IN EAST AFRICA

Digitalisation of education is a policy priority at most of the respondents' institutions

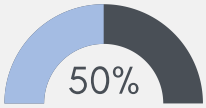


Agrees with the statement that digitaliation is supported financially at their institution

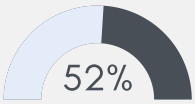
Most common forms of digital education*



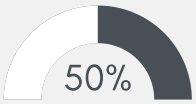
Pre-recorded presentations



Blended learning



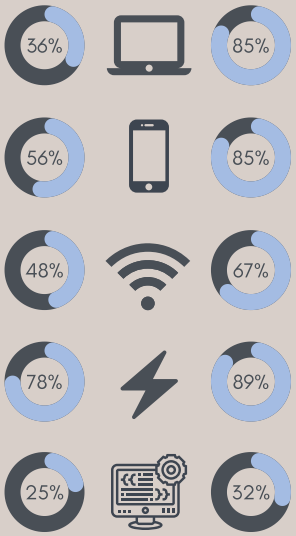
Digital education platforms



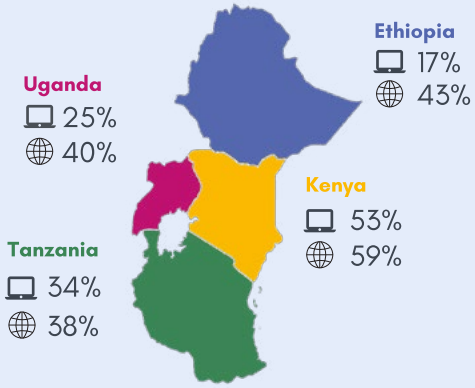
Online seminars

*percentage respondents that states that teachers at their institution use these forms of digital education

% respondents who indicated that students (left) and teachers at their institution often or always have access to a computer, a smartphone, reliable internet, electricity and software



Student access to a computer and reliable internet highest in Kenya*



*percentage respondents who indicated that their students often or always have access to a computer and reliable internet

Top 3 added values of digitalisation of education in the future

*respondents were asked to choose (max.) 3 out of 6 values

A. Introduction

> "African countries are ready for a comprehensive digital transformation strategy to guide a common, coordinated response to reap the benefits of the fourth industrial revolution."
> - *African Union, The Digital Transformation Strategy for Africa (2020-2030)*

In the Digital Transformation Strategy for Africa (2020-2030)[1], the African Union states that for the advancement of the digital economy, African countries need to digitalise their education. At the same time, the Dutch Advisory Council of International Affairs[2] points towards the digital divide between Africa and the rest of the world and the exacerbating role the COVID-19 pandemic has played:

> "There is an even greater disadvantage for an entire generation. [...] This development diminishes the prospects of work and income for millions of African young people."
> - *Advisory Council on International Affairs*

Digitalisation of education offers opportunities in enabling more young people to benefit from quality education and prepare them for the labour market. It is therefore important to strengthen digital infrastructure and enhance digital literacy among African students and teachers.

Intensifying European-African cooperation may be a way to support the development of digitalisation of education. However, such cooperation should be thought through carefully. The World Bank[3], an experienced player in the field of digitalising education worldwide, describes principles that should be kept in mind when developing initiatives that aim to invest in educational technologies. Initiatives should have a clear purpose, strategy and vision and should emphasise equity and inclusion in order to achieve scale and sustainability for all. Moreover, initiatives should take a multi-stakeholder approach, engaging a broad set of actors to support student learning, and should be data driven.

We hope that this study can provide some insight these priciples. By examining the current educational and digitalisation practices and experiences of teachers and staff at institutions in East Africa, we provide directions for future initiatives to enhance European-African cooperation and digitalisation.

Goal of the Study

This research is part of a collaboration between the British Council and Nuffic that aims to foster cooperation between Africa and Europe on digitalisation in tertiary education. The goal of this particular study is to investigate the current situation, needs, and opportunities for digitalisation of tertiary education in Tanzania, Ethiopia, Kenya, and Uganda.

By researching the experiences, practices, and needs of teachers and policy staff in these countries, this study:

1. Provides suggestions for follow-up projects that promote digitalisation in and cooperation with educational institutions in various countries in Africa.
2. Stimulates exchange of knowledge and closer educational cooperation between European and African countries.
3. Supports knowledge exchange between teachers at African educational institutions.

Research Questions

The research question we will answer in this study is:

> *What is needed to support the further development of digitalisation of tertiary education in East Africa?*

Specifically, we answer the following sub questions:

1. What is the current state of digitalisation of tertiary education in East Africa?
2. What do teachers and policy staff experience as challenges, needs, and possible solutions for digitalisation of tertiary education in East Africa?
3. What do teachers and policy staff see as the future opportunities and added value created by digitalisation of tertiary education in East Africa?

In what way can cooperation between European and East African education institutions contribute to the further digitalisation of tertiary education in East Africa?

Structure of the report

We start by describing the approach we took towards answering the research questions. We then provide an overview of the policy context in the four focus countries. We present the findings of the survey and focus groups, to then discuss what these findings mean for the further development of digitalisation. Finally, we review the main implications for future initiatives that arise from this study.

Positionality statement

As the Dutch organisation for internationalisation in education, we are part of a system that has been, and still is, based on unequal global power dynamics.

We acknowledge the years of colonisation, imperialism, and injustice that characterise the EU-African history. While initiatives to support education in East Africa are often well-intended, we cannot - and should not - isolate our work from the injustices that were committed in the past. **Equal partnerships** are an important issue for Nuffic and our work. Our goal is for our work to contribute to collaborations that restore equity.

As researchers working from the Netherlands, it requires constant reflection and effort to remain aware of the privileged position we are working from. We strive to, with our actions, take a small step in working towards educational collaboration on equal footing worldwide.

B. Approach

We conducted a mixed-methods study of the experiences of teachers and policy staff who work at TVET institutions and universities in East Africa. This approach consisted of a survey and focus groups, which we discuss below. Moreover, we conducted exploratory conversations and a policy- and context analysis to learn as much as we could about the local perspective. In this way, we tried to ensure that we could connect our results to the local context and that this study would be relevant to teachers and policy staff in East Africa.

Exploratory conversations

We held six online exploratory conversations with experts in the field of digitalisation in African education. These semi-structured conversations early in the research project helped us to determine the focus of the study and provided a first idea of the status of digitalising of education in the four focus countries. In these exploratory conversations, we learned that most institutions were not prepared to switch to online education when the pandemic started, mainly due to poor infrastructure and the lack of digital skills amongst teachers and students. Moreover, the experts emphasised the differences between rural and urban areas and TVET institutions and universities. We therefore included participants working in varying types of institutions and in both rural and urban areas, in order to capture a wide range of perspectives in our sample.

Policy and context analysis

In order to make well-informed recommendations regarding opportunities for the enhancement of digitalisation of education in East Africa, we provide an overview of recent (educational) strategies and policies. We specifically looked into:

- The African Union's strategic agenda on digitalisation,
- World Bank analyses on the digital economy and educational sector in the four focus countries,
- Current national policies on digitalisation in education in the four focus countries.

Survey

We designed a 23-question online survey to provide insights into the current practice and experiences of teachers and policy staff with respect to the digitalisation of education. Teachers and policy staff partly received different questions, appropriate to their position at their institution. The survey allowed participants to further share the survey within their network.

Of the 317 total survey respondents, 97 respondents were excluded because they 1) ended the survey prematurely (before answering the questions about the current state of digitalisation at their institution), 2) did not work in one of the four countries, or 3) did not work in tertiary education. This resulted in a total dataset of 220 respondents. More details about the characteristics of the respondents can be found in the results chapter.

Topics in the survey were:

- Current practices and digital skills of teachers, students, and staff;
- Challenges and obstacles;
- Immediate needs;
- Hopes, expectations, and expected added value associated with digitalisation of education.

For the full survey, **see Appendix 1**.

Focus Group Discussions

We conducted three online focus group discussions: one with policy staff (4 participants) and two with teachers, lecturers, or professors (7 participants in total). All participants signed a consent form (**see Appendix 2**) and received compensation for their internet usage during the online meeting.

For each focus group, we ensured that participants from all four countries were represented. This way, the focus groups provided us with input from the various contexts, enriching the conversations. Moreover, the different country contexts represented allowed for knowledge exchange between the participants. Specifically, the following topics were discussed:

- Current "state of digitalisation" at their institutions
- Experiences, needs, obstacles, and opportunities from their teaching perspectives
- Regulations and governmental support (for policy staff only)
- Ideas for future collaborations either nationally or internationally.

For a full overview of the focus group protocol, **see Appendix 3**.

We transcribed the recordings with the software Otter. We coded the various themes with the software NVivo, which helped us identify common themes and patterns and structure our findings accordingly.

Community of Practice

We created a **Facebook page** for teachers and policy staff who work in the four focus countries. The platform aims to facilitate teachers and staff in the further application of digital tools in education, by meeting fellow teachers, exchanging experiences, and sharing relevant information and support. The research team took an active role in providing supporting materials for the teachers and policy staff in this Community of Practice.

Acknowledgements

This research would not have been possible without the great people who helped us throughout the process of this study.

Thanks to the experts who helped us think through what questions to ask and how best to answer them. A special thanks to Professor Andrew Ssemwanga and Mariam Basajja for providing us with valuable insights in the early stages of the research. As researchers, we were always at a distance because of the COVID-19 crisis. All the interaction had to take place online. Your input helped us tune in to the context in East Africa and meant we could build on existing insights.

Also, thanks to our dear colleagues Huba Boshoff and Itumeleng Dhlamini for supporting us with their expertise from the Neso South Africa.

Finally, we would like to thank all the participants for helping us with this study, sharing their experiences, providing their perspectives, and connecting us to their relevant networks of professionals. With the results of this study, we hope to support you in your work to develop your educational system and provide all students with opportunities to learn and grow.

C. Overview of policies and country contexts

For the purpose of this study, we have explored the policy context of the four countries by reviewing relevant policy documents that are available from global, continental, and national institutions (the reference list is provided in **Appendix 5**).

We will discuss the definition and scope of digitalisation in education and its context in East Africa and provide an overview of the strategic agendas of both the African and European Unions and their collaboration. Moreover, we look at national policies and the state of the digital economy in the four focus countries to provide an idea of each country's digital landscape. Finally, we offer some conclusions on how the four countries compare.

Digitalisation of education

When discussing digitalisation in education and its context in East Africa, it is important to consider a) the increased urgency to prepare all students for a digitalised world, b) current digital divides and inequalities, and c) the definition of digital transformation.

The need and increased urgency to prepare all students for a digitalised world
It is widely understood that the world is in the midst of a technological revolution. It is expected that the biggest impacts of this Fourth Industrial Revolution[4] will be to improve quality of life and reduce poverty and inequalities. Yet, in the World Bank's recent approach paper on digitalisation of education[5], it is stated that students are still not being adequately prepared to thrive in this rapidly changing world. Educational systems, especially in low- and middle-income countries, are only slowly adopting technologies and face many challenges. For example, higher education is out of reach for the vast majority. The African Union states in their Digital Transformation Strategy for Africa[6] that enrolment in higher education is less than 10% on average in the majority of African countries.

Adding to those challenges, the recent COVID-19 pandemic caused around 1.6 billion children and youth in over 180 countries worldwide to face closures of schools and educational institutions[7]. Governments and institutions had to adapt rapidly to remote learning. The pandemic highlighted existing inequalities in digital access and digital skills. Remote learning and digital education does not deliver education to all students (yet). Beyond the immediate emergency response to COVID-19, the crisis compelled governments and institutions to

re-examine their educational models in order to address issues of access, continuity, and quality, as seen in the recent digital strategies of Uganda[8] and Ethiopia[9], and the recent inventory among 500 African government officials and educators by the Global Online Education Alliance[10].

Considering the digital divide and existing inequalities

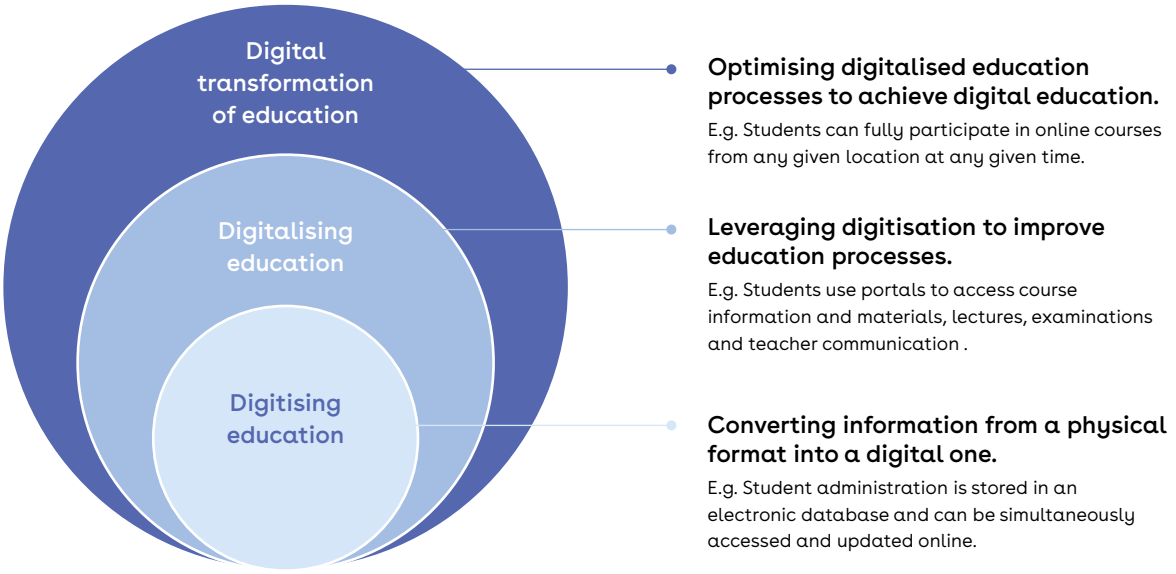
Unequal access to computers and internet creates a so-called *digital divide* between those with and without access. As the OECD and World Bank address[11], there is a second digital divide in digital skills, and it separates those with the ability to benefit from computer use from those without that ability. In Sub Saharan Africa, these digital divides are more pronounced, due to significant differences in social capital between different socio-economic status groups, between rural and urban areas, between men and women, and between younger and older people[12]. Investments in the digitalisation of education therefore need to avoid only benefitting those who already have a head start due to some degree of access and skills, as well as a more supportive environment.

As the African Union states in their Digital Transformation Strategy for Africa, building the digital capabilities of all students, especially those at risk of being left behind, will enable *"progress towards the foundation for Sustainable Development Goal (SDG) education indicator 4.4.2: The percentage of youth/adults who have achieved at least a minimum level of proficiency in digital literacy skills"*. Increased digitalisation of education in East Africa therefore not only potentially benefits the countries' educational quality, it can also contribute to increased global equity.

Defining digital transformation of education

This study defines digitalisation of education as the increased use of digital tools and technologies during teaching and learning. There are different levels of digital education, as shown in Figure 1. Digital transformation is achieved by moving away from more traditional analogue education systems and making optimal use of digitised education content and digitalised education processes in order to provide digital education for learners.

Figure 1: *Digitising, digitalising and digital transformation of education*



Current issues of access, connectivity, and affordability limit the possibilities of education institutions in East Africa and their chances for full digital transformation. However, as mentioned previously – technology is merely a means to an end, as is digitalisation. Therefore, it remains crucial to look at the process of digitalisation with the purpose and added value of the digital transformation of education in mind.

International strategies for digitalising education

COVID-19 created an urgent demand, but digitalisation is not new and will not disappear from the policy priority list anytime soon, since the technological revolution is still moving forward. Especially in Africa (currently the least connected continent in the world according to the Technology Report 2019 of the International Association of Universities[13]), there is an ambitious agenda to connect the continent to the unlimited possibilities for development offered by digitalisation.

The African digital transformation strategy and education

The African Union has developed its Digital Transformation Strategy 2030[14] with "*digital skills and human capacity*" being one of the foundation pillars. According to the Union "*the supreme currency in the digital age is people and their skills*". It states that with an "*appropriate and coordinated human and institutional capacity development strategy, Africa's most precious asset, the youth who constitute 60% of the overall population, can be remodelled, harnessed, empowered and transformed into a digitally adaptive, skilled and innovative workforce that not only comprehends, adopts and moves with global trends but charts its own digital pathways towards inclusive growth and development*".

One of the obvious pathways to ensure Africa's youth is digitally skilled is (digital) education. The educational sector will be critical in helping to prepare the workforce and contributing to the inclusiveness of these transformations, thereby reducing poverty and inequality. Moreover, digitalisation is a unique opportunity to transform the delivery of education itself, according to the African Union.

The African-European partnership

The European Union supports Africa's digital transformation strategy. The partnership emphasises the importance of further developing quality learning and vocational training opportunities that are delivered by public and private education institutions. An important initiative in this respect was the launch of EU-AU Digital Economy Task Force in 2018[15]. This Task Force aims to increase access to tertiary education via Open Distance and eLearning resources and provides recommendations based on access to affordable broadband connectivity and digital infrastructure, digital skills, digital entrepreneurship, and e-Services.

Complementary to the work of this Task Force is the *AfricaConnect* initiative[16], launched by the EU in 2011. The current third phase of the initiative aims to enhance human capital development in Africa, especially through promoting the use of digital technologies by African research and educational institutions. Currently, 15 African countries deploy the global wi-fi roaming service *Eduroam* at universities and research institutions, with a further five countries running pilots.

The recent European political agreement on the Neighbourhood, Development, and International Cooperation Instrument (NDICI) for 2021 to 2027[17] will play a key part in Europe's international development cooperation, with a focus on the twin objectives of green and digital transitions, including supporting education and youth development.

National policy contexts

In order to make well-informed recommendations on how to support the digitalisation of education in East Africa, it is essential to be aware of recent (educational) policies. These country analyses will allow us to contextualise the findings of this study and formulate relevant implications and recommendations.

We have zoomed in on the national and, as far as quality information was available, educational policies of the four countries examined in this study. The short country profiles are based on recent World Bank publications on the countries' digital economies and national strategies and policies for digitalisation (of education). The availability, quality, and level of detail of the available policy documents varied by country. Therefore, this policy analysis is not a comprehensive *comparison* of countries but rather serves as context *description*.

For a more comprehensive and quantitative study on digital education in Africa, including the four focus countries of this study among others, we refer to the report by HCSS[18] that was done in parallel to this study.

Tanzania; A conducive digital environment with affordability and accessibility issues

The World Bank describes in its Country Overview[19] that Tanzania has shown a steady macroeconomic performance in recent years. Tanzania is classified a lower-middle income country. While the poverty rate in the country has declined, the absolute number of poor citizens has not. This is mostly due to the high rate of population growth. With a large number of people living just above the poverty line, many are at risk of slipping below it. Education indicators improved between 2011 and 2018, but gaps between poor and non-poor children are substantial, and they are even larger between rural and urban areas, according to the World Bank's Economic Update on Tanzania[20].

As the World Bank describes in their Economic Update, the entry of mobile provider Halotel in 2015 had a major beneficial impact on access for Tanzanians. It pushed coverage from 20% in 2015 to 61% in 2018. Still, internet usage is low compared to neighbouring countries, as prices for low-volume data packages are high. Dar es Salaam is one of the most expensive cities in Africa to procure international internet bandwidth. At the same time, data quality is poor.

Digital skills and education

In their Development Vision 2025[21], the Tanzanian government highlights the importance of "a science and technology culture", emphasising technology education to building the skills and capacities of Tanzanians in ICT, starting at the lower levels of education. NACTE, the National Council for Technical Education in Tanzania, estimated in their skills mapping report[22] that in the period from 2014 to 2019, over 95,000 graduated technicians entered the labour market, of which 27% had specific ICT related skills. The report mentions that over 60% of employers in Tanzania report an overall skills gap, including IT skills.

In the recent State of Higher Education Report (2019)[23], the Tanzanian Commission for Universities (TCU) found that 100% of public university institutions have an ICT policy in place, compared to 76- 82% of privately owned institutions. A significant proportion, 41 out of the 60 university institutions in Tanzania, are privately owned. In 2019[24] the TCU reported that while

most students (around 175,000) followed full-time physical university education, some 10,000 students were currently enrolled in Open Distance Learning (ODL) in Tanzania, mostly in the fields of education and social sciences.

Uganda; Lagging behind its peer nations with large access and skills gaps, but making strides

Uganda has made strides in digital transformation, with increased access to digital connectivity and digitally enabled services. However, it continues to lag behind peer nations, as described by the World Bank in their recent Economic Update on Uganda[25]. The country, with a low-income status, has approximately 27 million mobile subscriptions, which is a penetration rate of 69% of the population, far below the average of 84% for Africa. Furthermore, the World Bank describes a gender and geographical gap in access to digital technologies. Ugandan women have less access to mobile phones compared to men, and adults in rural areas (25%) are less likely to own mobile phones compared to those in urban areas (70%). Affordability remains a key challenge to broadband connectivity in Uganda.

Digital skills and education

Gaps in basic and advanced digital skills are a challenge for the digital transformation of Uganda. Only recently, pushed by the COVID-19 pandemic, has the Ugandan government developed a national ICT plan, including policy strategies for education and closing the skills gap. This Education Digital Agenda Strategy for 2026[26] sets standards and guides the integration of digital technologies in education. It is aligned to the National Development Plan (NDP) II and NDP III, which advocate for human capital development in the education sector, leveraging ICT use and penetration, resulting in improved learning outcomes.

At the same time, the gross enrolment rate for higher education in Uganda is lower than 7% (some 260,000 students in 2017), as reported by NCHE, the Ugandan Council for Higher Education, in their 2017/18 Report[27]. Furthermore, NCHE developed a minimum standard for undergraduate ICT courses in 2014, which requires revision due to the rapid developments in the field. Uganda's Digital Agenda Strategy mentions the need *"to update the curriculum for STEM courses to bring it into line with digital advances and to re-skill the teaching human resources to enable them to teach advanced digital skills"*.

Kenya; Integrated digitalisation, but challenges with training and access remain

The World Bank describes Kenya's significant political, structural, and economic progress over the past decade in their Country Overview[28]. As a lower-middle income country, its key challenges still include poverty, inequality, continued weak private sector investment and the vulnerability of the economy to internal and external shocks.

The recent World Bank Economic Update on Kenya[29] states that "*the Government of Kenya is eager to position the country as a hub for information and communication, e-commerce and digital services*". Mobile penetration continues to rise, providing access to digital communications, and increasingly to the internet. The World Bank describes how "*investments have helped more Kenyans to get online, but broadband infrastructure and market bottlenecks persist which reduce coverage, speed, reliability and affordability of services*".

Digital skills and education

The World Bank concludes that the country is making progress in embedding digital skills into the national education system. Kenya implements a competency-based framework featuring digital skills in its education system, and policies and programs promoting the use of ICT for teaching and learning are formally in place.

The Kenyan Ministry of Education's National Education Strategy for 2022[30], under Kenya's Blueprint Vision 2030, includes the following programs: Digital literacy in all public primary schools (Digital Literacy Program, DLP); ICT Integration in Curriculum Delivery and Assessment (in TVET); Open Distance and E-learning in University Education; Reviewing of (digital) curriculum and content in Universities; and a National Education Management Information System (NEMIS). Nevertheless, the World Bank concluded that challenges remain, such as gaps in access to adequate teacher training and digital content, as well as access to digital devices and connectivity.

Ethiopia; Digital economy at an early stage, especially in rural areas

Ethiopia is the second most populous nation (112 million people) in Africa and has a fast-growing economy, although it is also one of the poorest nations. Ethiopia aims to reach lower-middle-income status by 2025, as described in the World Bank's Country Overview[31]. The country is currently dealing with political unrest and internal conflict, undermining the development outcomes it has achieved in recent years.

In 2020, the Ethiopian Ministry of Innovation and Technology developed a National Digital Transformation Strategy for 2025[32], aligned with national documents such as the 2019 Homegrown Economic Reform Agenda and the Ten-Year Development Plan (2020-2030). Furthermore, Ethiopia has aligned the strategy with international commitments such as the Sustainable Development Goals and the African Union's Continental Digital Strategy.

The national strategy describes Ethiopia's digital economy as being at an early stage. While Ethiopia has advanced out of an analogue state in some areas, digital penetration remains low and few citizens access government and private services via the internet. "*Mobile (60%) and internet (45%) coverages are still low compared to peer nations. Electricity access to households is 44%, with a major difference between urban (96%) and rural (31%). Internet quality and reliability is generally poor. The international bandwidth per user and average download speeds are both lower compared to African peer nations*".

Digital skills and education

The national digital transformation strategy highlights important aspects of Ethiopia's education strategy and challenges regarding digitalisation. Ethiopia's education targets need to go beyond basic literacy (Ethiopia has lower literacy rates compared to its peer nations) to include digital literacy, with a focus on Ethiopia's rural population (constituting 80% of the total). Initiatives are currently underway to address digital literacy gaps and introduce digital programs to help 70% of Ethiopians become digitally literate by 2025, according to the national strategy. The government is also investing heavily in tertiary education, allocating 48% of the total education expenditure to this sector. Despite increases in university enrolment, higher education curriculums have not evolved to match the changing needs of the (digital) workplace. The lack of standardised digital training and skills assessment systems throughout the whole educational system has resulted in students with poor digital skills.

How do the four countries compare?

Since the policy analysis aimed at providing contextual information for our study findings, we can only draw tentative conclusions. However, we have found that all four countries have national and/or educational strategies that mention the importance and urgency of developing ICT education and digital education to foster digital skills among learners, enabling the population to contribute to local economic activity and development.

The four countries have comparable challenges, but also differ in their local characteristics and demographics. Technological developments are in different stages and the countries have varying opportunities available to leverage and promote digitalisation. While Kenya is ahead in connectivity and access, the other countries face more challenges in fully connecting their populations. Tanzania appears to occupy the next best position, being as well connected as Kenya, but having more issues with affordability and (equal) access. Uganda and Ethiopia are both developing ambitious strategies to close the digital gap and increase their connectivity, especially within rural communities (which in Ethiopia constitute 80% of the population), while economically the starting position for reaching these goals appears less strong. Poverty and inequalities remain issues for all four of the countries, creating gaps between rural and urban populations, men and women, and poorer and richer communities. Up to now, Kenya has shown the most progress in practice by implementing and integrating digital skills education into their national education system.

We can conclude that all four countries are working towards a more digitalised economy, including a capable and well-educated workforce, equipped with digital skills. It is critical to ensure that the approach for the digital transformation of education fits the national vision, circumstances, and priorities.

D. Results

In this section, we present the findings from the survey and focus group discussions among teachers and policy staff in the four countries. We first describe our sample and then structure the findings in four parts, based on the four research questions. The first part concerns the current state of digitalisation and investigates to what extent digitalisation is a policy priority for institutions, as well as the impact of COVID-19 and the current use of digital tools. Secondly, we examine what teachers and policy staff see as challenges, needs, and possible solutions in relation to infrastructure, digital skills, and governmental/institutional support. In the third part, we focus on the possibilities and added value of digitalisation and some potential risks, as perceived by the respondents. Lastly, in part four, we refer to opportunities for the further development of digitalisation through cooperation between European and East African education institutions.

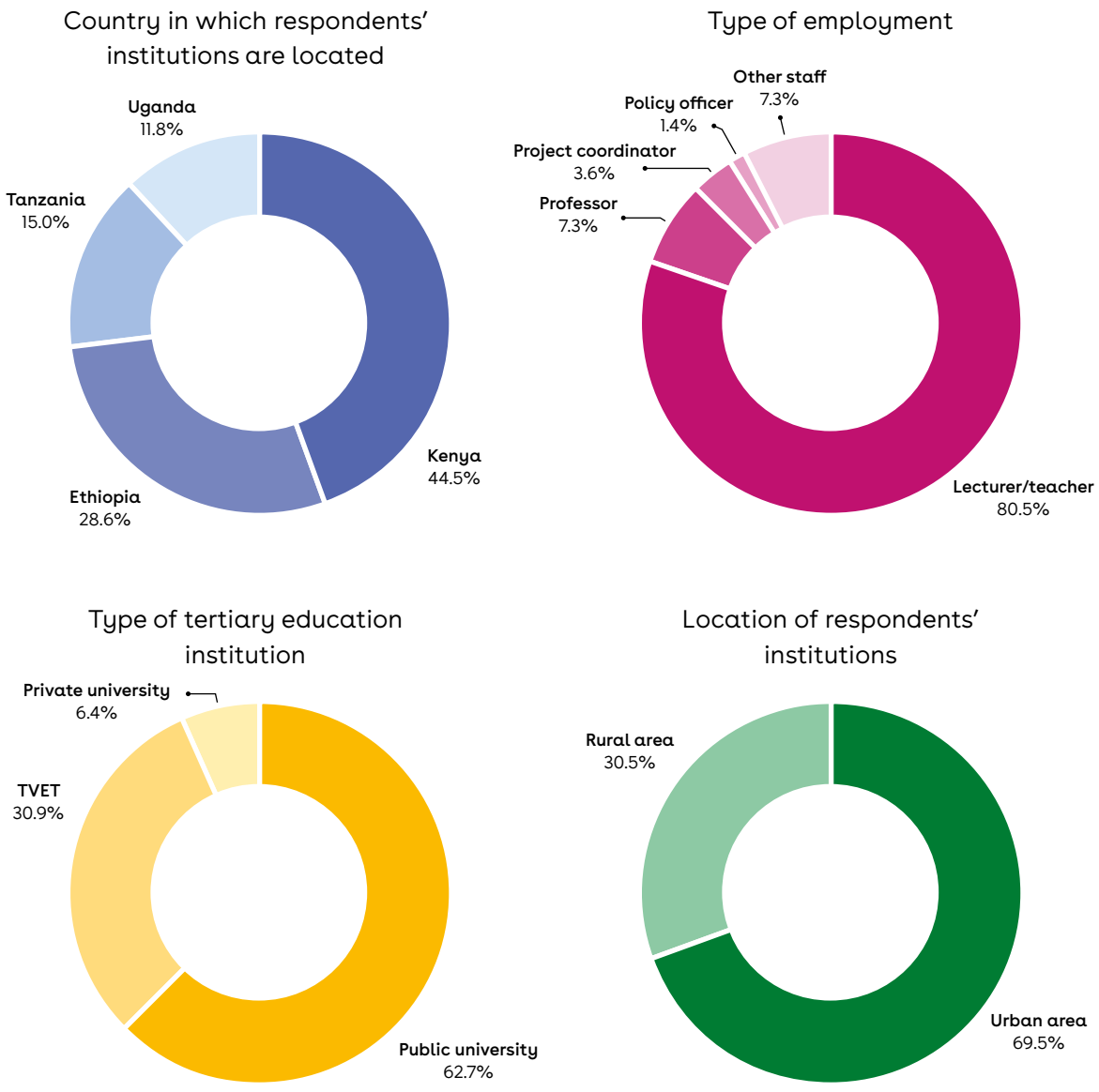
Who participated in the survey?

The charts in figure 2 give a visual overview of respondent characteristics. The average age of the respondents is 39.2 years, with the youngest respondent being 23 and the oldest 77 years old. We asked the respondents to provide the name of their institution in order to define the spread of the respondents. The 191 respondents who did so work at 101 different institutions.

The institution with most respondents is a Kenyan university with 16 respondents, making up 7.2% of the total dataset. For all countries, respondents from at least 10 different institutions filled in the survey (10 Tanzanian institutions, 16 Ugandan institutions, 32 Ethiopian institutions, and 43 Kenyan institutions).

In terms of representativeness, it is possible (even likely) that the respondents who filled in our online survey are more interested in digitalisation of education and/or are more digitally skilled than the average teacher and policy staff member working in tertiary education in East Africa. For example, as the survey was distributed online, individuals with very limited digital skills and/or those who do not have a reliable internet connection, might be underrepresented in our sample.

Figure 2. *Summary of respondents' characteristics*



I. What is the current state of digitalisation of tertiary education in East Africa?

Digitalisation is a high policy priority at a majority of the respondents' institutions in all four countries. COVID-19 increased the urgency to digitise education resources and digitalise education processes. However, the current practice of digitalisation is limited and mostly at a basic level. Some examples of digital tools used by respondents are emails, PowerPoint presentations, online learning platforms, and administration platforms.

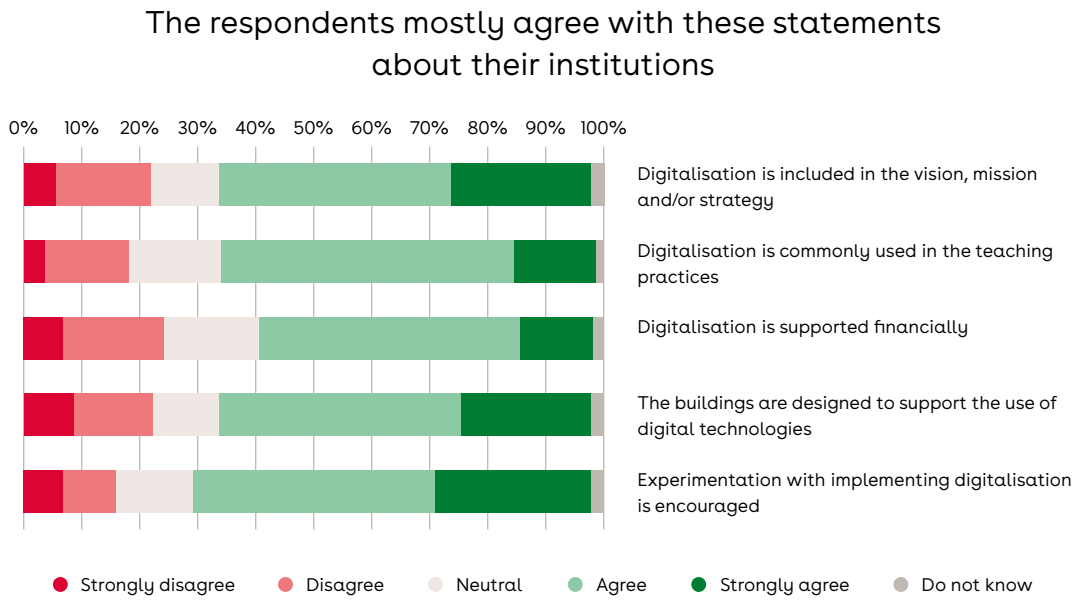
Digitalisation of education is a policy priority for institutions

With regard to the policy priorities of education institutions, we found more or less similar results for the four countries. For each country, about half of the respondents indicated that digitalisation is either a high or the highest policy priority (ranging between 45.5% (Tanzania) and 61.5% (Uganda)). And in every country, less than 19% indicated that digitalisation is either a low priority or not a priority.

In addition, there were some small differences between the different types of institutions. Employees at private universities indicated most often that digitalisation is a high or the highest priority (57.1%), followed by public universities (53.6%), and vocational/technical education (48.5%).

We then presented 5 more in-depth/specific statements about the current state of digitalisation of education at the institutions (see figure 3). For each of the statements, at least 57% of respondents indicated that they agree or strongly agree. The respondents agreed most with the statement that experimentation with implementing digitalisation is encouraged at their institution (68.6% agreed or strongly agreed with this statement) and they agreed least with the statement that digitalisation is financially supported (57.7% agreed or strongly agreed with this statement).

Figure 3. *The extent to which the respondents agreed with the following statements about their institutions (N=220)*



COVID-19 helped highlight the importance of digitalisation

Due to the COVID-19 pandemic, staff could not continue offering face to face classes as they used to do before the pandemic. The need for digital education emerged overnight. Especially since the outbreak, participants in the focus groups indicated that digitalisation became an urgent need and that institutions responded to the crisis and made efforts to enhance the provision of digital education.

When the pandemic started, some institutions managed to provide some online learning options, while other institutions were not able to switch to online education. As a result, educational activities stopped completely at these institutions. One participant in the focus group discussion mentioned:

> "Universities closed completely in the area, there was no effort to try to continue with teaching because I think we were not that prepared to do so."

Participants in the focus group discussions mentioned that even though COVID-19 may be temporary, their priority for digital education will continue to move forward. They feel that they will continue their efforts to digitalise education:

> "We cannot drop technology. Now, we're approaching towards it. So, we cannot detach ourselves from digitisation."

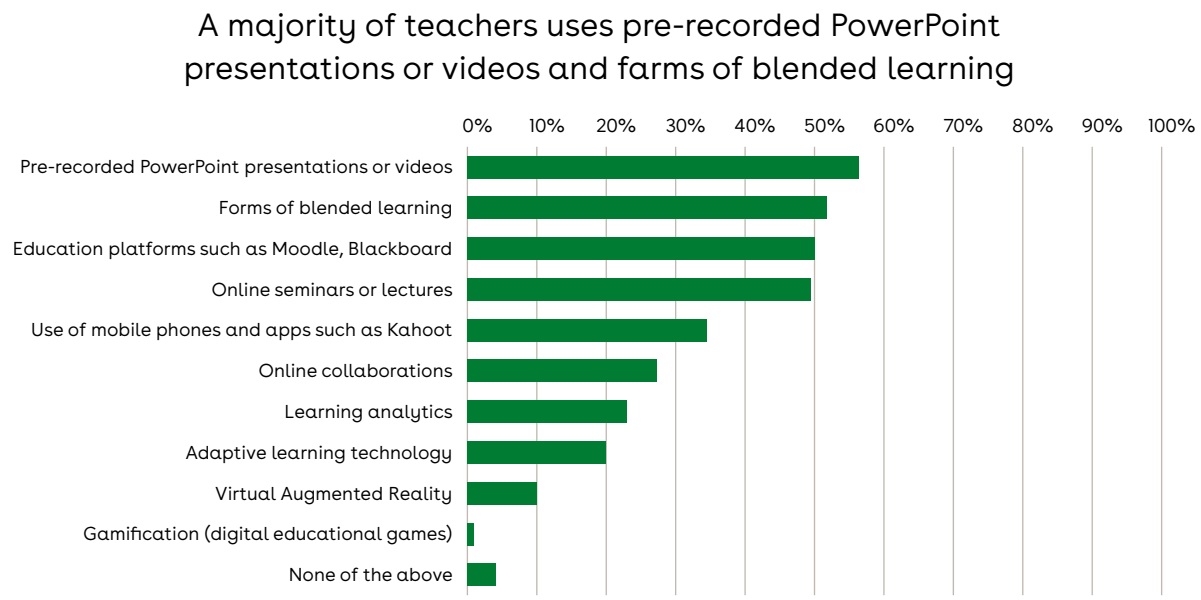
Digitalisation is currently limited

Based on the focus group discussions, the practice of digitalisation in participants' daily work is limited and at a basic level. Participants mainly use emails, PowerPoint, digital library, online learning platforms (i.e. Google classroom, Moodle), and social media (e.g. Telegram, Facebook, WhatsApp).

The survey showed similar results. We asked respondents to name one good example of digitalisation at their institution. Based on their responses, we identified two main categories of current digitalisation practices: 1) online learning tools, such as Moodle, Zoom, and Open Distance e-Learning (ODeL), and 2) digital administration tools, such as student information and registration systems. Other examples were the implementation of a digital library, the establishment of an ICT department, the development of a website, and the use of PowerPoint presentations.

Respondents in the survey indicated that the use of different forms of digital education is limited. Around 50% of the respondents indicated the use of PowerPoint presentations, education platforms, online lectures, and blended learning (a combination of traditional place-based classroom methods with online educational methods). More recent techniques (virtual/augmented reality and gamification) are the least applied forms of digital education at the institutions.

Figure 4. *Respondents' answers to the question: which forms of digital education are currently being applied by the teachers at your institution? (N = 220, multiple answers possible)*



Moreover, respondents indicated that the teachers at their institution apply, on average, 3.2 different forms of digital education. Nine respondents indicated that none of the forms are currently being applied and one respondent stated that all forms are being applied by the teachers at his/her institution.

Respondents who work at private universities use the most forms of digital education (on average 4.3), which is more than a one-point difference relative to TVET (3.2) and public universities (3.1).

II. What do teachers and policy staff perceive as challenges, needs, and possible solutions for tertiary education in East Africa?

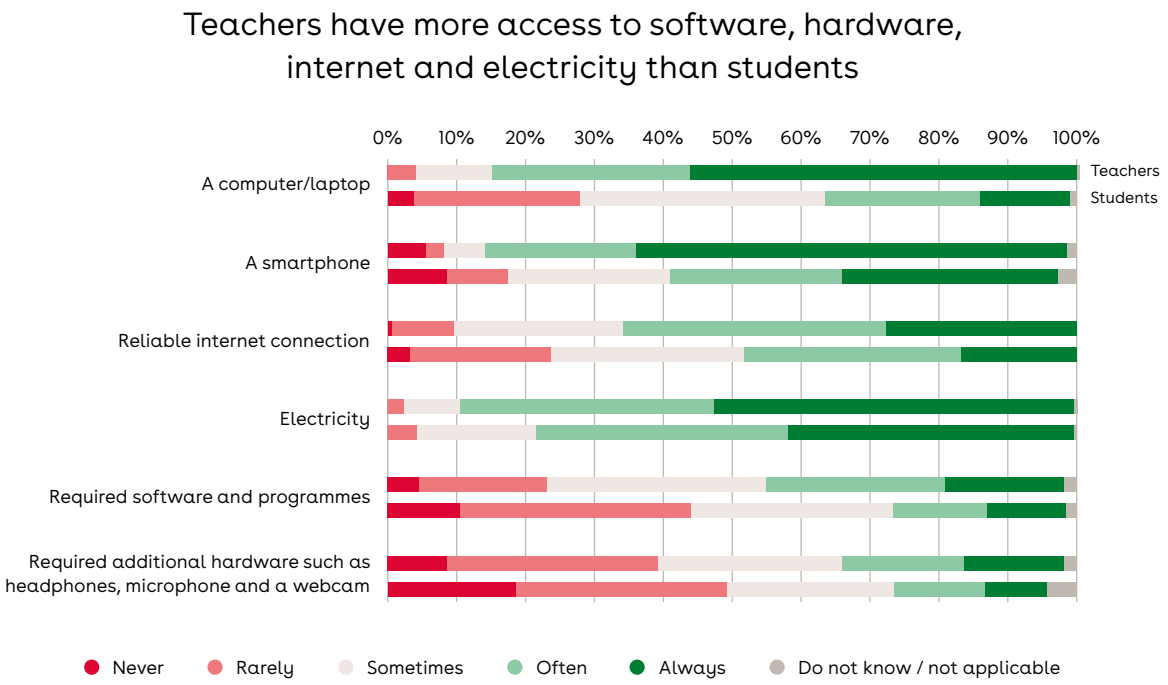
The quality of infrastructure is limited, resulting in unequal access to reliable and affordable internet and computer equipment, especially among students. Besides, teachers and students often lack the necessary digital skills to be able to use technology. Among some teachers and staff, there is resistance towards digitalising education or a lack of awareness of the possible benefits of digitalisation. Another challenge is the limited financial support from the government and the institutional management.

Limited and unequal access to reliable internet and equipment

Making use of digital education requires access to the necessary software and hardware, as well as a connection to reliable internet and electricity. We therefore examined - with the survey – how often students and teachers have access to a computer/laptop, a smartphone, reliable internet connection, electricity, required software and programmes, and required additional hardware (headphones, a microphone, and a webcam), according to the professors, teachers and lecturers (figure 5).

Teachers have more frequent access to each necessity compared to students. The largest difference is seen in access to a computer (laptop): 85.0% of respondents indicated that, on average, teachers at their institution often or always have access to a computer, whereas 35.6% of respondents stated that their students often or always have access to a computer. Moreover, about half of respondents indicated that their students, on average, only sometimes, rarely or never have access to a reliable internet connection, and for teachers' access, this percentage is 34.1%.

Figure 5. *Respondents' answers to the questions: 1) On average, and during this educational year, how often do teachers at your institution have access to the following? 2) On average, and during this educational year, how often do students at your institution have access to the following? (N = 191, only professors, lecturers and teachers)*



There are differences between the countries when it comes to both teacher and student access to the necessities, as presented in table 1. For example, student access to computers is much higher in Kenya (52.5% often or always have access to a computer) than in Ethiopia (17.0%). In fact, student access to every necessity is highest in Kenya and this is also the case for teachers' access to 3 of the 6 necessities (reliable internet connection, electricity, and required software and programmes).

Table 1. *Respondents' answers to the questions: 1) On average, and during this educational year, how often do teachers at your institution have access to the following? 2) On average, and during this educational year, how often do students at your institution have access to the following? The percentage is the sum of 'often' and 'always'.*

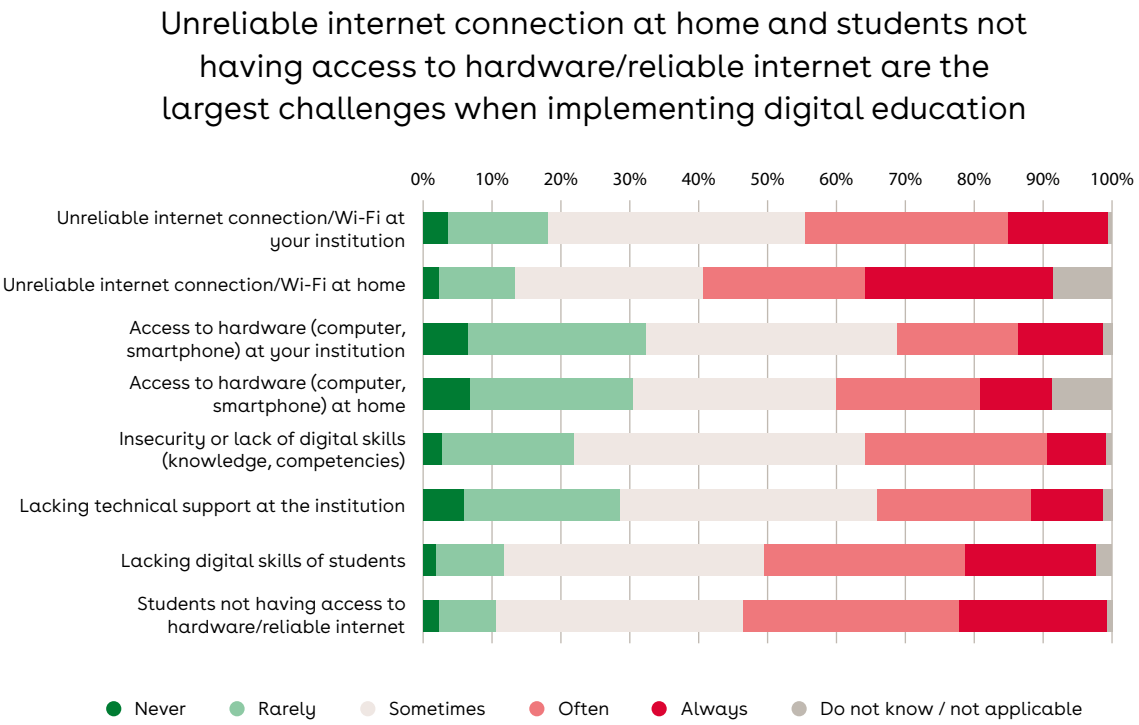
		Computer/laptop	Smartphone	Reliable internet connection	Electricity	Required software and pro-grammes	Required additional hardware*
Student	Kenya	52.5%	68.3%	58.8%	85.1%	30.1%	28.8%
	Tanzania	34.4%	64.5%	37.6%	75.1%	37.5%	21.9%
	Uganda	25.0%	60.0%	40.0%	65.0%	20.0%	21.1%
	Ethiopia	17.0%	34.4%	43.1%	74.6%	13.6%	13.8%
Teacher	Kenya	80.7%	93.9%	70.5%	97.9%	52.0%	31.6%
	Tanzania	84.8%	97.0%	54.5%	81.8%	51.5%	42.5%
	Uganda	85.6%	88.4%	57.7%	73.1%	30.7%	30.7%
	Ethiopia	90.4%	61.9%	68.2%	85.7%	30.1%	28.6%

**e.g. headphones, microphone and a webcam*

We also asked respondents in the survey how often the teachers at their institution experience certain challenges when implementing digital education (see figure 6). At least 30.0% of respondents indicated that all given challenges were experienced often or always by teachers at their institution. Students not having access to hardware/reliable internet and an unreliable internet connection/Wi-Fi at home seem to be the largest challenges (52.8% and 50.9% stated that this is often or always the case, respectively). Moreover, on the open-ended question: *"If you could choose one thing that would help you implement digitalisation at your institution starting tomorrow, what would that be?"* a majority of respondents suggested that infrastructure should be improved:

> "Reliable internet and electricity for me and my students! And access to computers for my students."

Figure 6. *Respondents' answers to the question: How often do teachers at your institution experience the following challenges when implementing digital education? (N = 220)*



Moreover, 94.2% of respondents found it important or very important to have better IT infrastructure/facilities. 95.6% indicated that, to further develop digitalisation, they would benefit to a high or very high degree from better IT infrastructure/facilities.
These survey results were in line with responses during the focus group discussions. All participants in the focus group discussions mentioned infrastructure as a daily challenge in their work. The main infrastructure challenges are related to electricity issues, especially in rural areas, and the unreliable internet connection. A participant emphasised:

> "There is no internet, even in my office. Most of the time, internet will be gone and come and there's no connectivity, it is very weak. So, there should be a rebuilding of facilities regarding internet connectivity."

Reliable internet connectivity is limited at the institutions, but often even more difficult at home. A participant mentioned that their institution reached out to a local Telecom provider to provide better access to Wi-Fi for staff members at their homes.

Internet connectivity is especially problematic for students, making online or distance education a challenge. A participant mentioned that especially for female students, studying from home is difficult, not only because of the unreliable connection, but also because their home situations often mean they are burdened with domestic work while at home.

Moreover, many students have limited financial resources to cover the costs of internet or data bundles. Poverty is a big obstacle forcing students to prioritise other necessities. For instance, a participant mentioned that some students can only afford to spend $6 per month, which is not even sufficient for their food expenses. Therefore, even if infrastructure is made available, there is a need to make it affordable or even available for free.

Another issue is the lack of equipment, such as laptops and smartphones, especially among students:

> "Students do not have smartphones. The majority of the students are coming from rural areas, and they don't have [smartphones]. And staff members, they don't have computers, laptops, which enable them to conduct discussions with laptops with audio video."

One participant explained that they are having conversations with their government to provide fundraising in the form of student loans to acquire laptops, which can be repaid after completion of the study.

Lack of digital skills and hesitation to use technology

Besides access and connectivity, which one participant referred to as an *"a-priori need"*, more is required to implement digitalisation in education. People, both students and (teaching) staff, need digital skills and an increased level of awareness and interest in using digital tools for educational purposes.

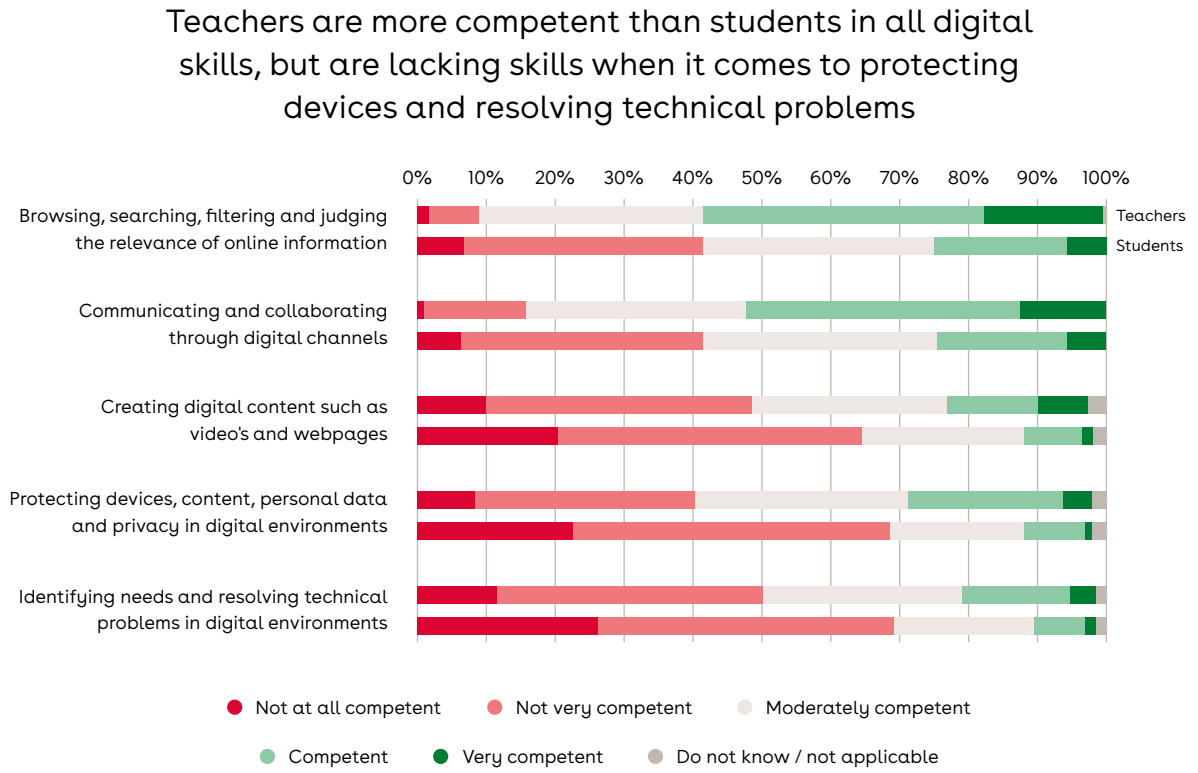
To get an indication of the digital competences of both teachers and students in East Africa, we used the five competence areas of the European Union's DigComp 2.0 framework[33]. In particular, we asked teachers to rate both themselves (their colleagues) and students at their institution (ranging between 1 = not at all competent and 5 = very competent) (see figure 7). While interpreting the data, one should keep in mind that the students themselves did not fill in this survey.

For each competence area, at least 49.8% of respondents rated the teachers at their institution to be moderately competent or (very) competent. Respondents rated the teachers best on the competence area 'browsing, searching, filtering and judging the relevance of online information' (91.1% indicated that the teachers at their institution are at least moderately competent in doing this), and worst on 'identifying needs and resolving technical problems in digital environments' (49.8% indicated that the teachers at their institution are at least moderately competent in doing this, and only 19.4% indicated that the teachers at their institution are competent or very competent in doing so).

On average, respondents rated the students as less competent in all digital skills compared to the teachers. Only for two of the digital competences, a majority of the respondents indicated that the students at their institution are at least moderately competent ('browsing, searching, filtering and judging the relevance of online information' and 'communicating and collaborating through digital channels', 58.7%, and 58.6%, respectively). Comparable to their rating of teachers, respondents rated students worst at 'identifying needs and resolving technical problems in digital environments': only 30.9% of respondents indicated that the students at their institution are at least moderately competent in doing this. Furthermore, it is important to note here that most respondents indicated that teachers and students are not very competent in protecting devices, content, personal data, or privacy. In part III of the results section, we further discuss security issues as a potential risk of digitalisation.

After calculating the average digital skills[1], we found that in all four countries the respondents rated the digital skills, on average, higher for teachers than for students[2]. Moreover, respondents who work at private universities rated student and teacher skills as slightly higher than respondents who work at public universities and TVET institutions[3]. Lastly, respondents who work at institutions in urban areas rate the teacher skills as slightly higher than the respondents who work at institutions in rural areas. There is no difference between these groups when it comes to student skills[4].

Figure 7. *Respondents' answers to the questions: 1) On average, to what extent are teachers at your institution competent in the following digital skills? 2) On average, to what extent are your students competent in the following digital skills? (N = 191, only professors, lecturers and teachers)*



During the focus group discussions, participants also mentioned that the lack of digital skills among teachers and students is a major challenge. Especially older teachers are less familiar with technology, resulting in a so-called 'skills gap'. Students are also limited in their development of digital skills since many of them interact with computers for the first time only when they enter university. For instance, one participant mentioned:

1) For each case, we divided the sum of the digital competences (1 = not at all competent, 5 = very competent) by 5 in order to calculate the average digital skills. The respondents who had at least one missing value (e.g. do not know/not applicable) were excluded from this calculation.

2) In Kenya the average student skills is 2.6, the average teacher skills is 3.0, in Tanzania the average student skills is 2.5, the average teacher skills is 3.1, in Uganda the average student skills is 2.1, the average teacher skills is 2.7, and in Ethiopia the average student skills is 2.3, and the average teacher skills is 3.1.

3) The respondents who work at a vocational/technical education institution rate the student skills on average at 2.4 and the teacher skills at 2.9. For public universities, these number are 2.4, and 3.1, and for private universities these numbers are 2.7 and 3.3, respectively.

4) The respondents who work at an institution in an urban area rate the student skills on average at 2.4 and the teacher skills at 3.1. For institutions in rural areas, these numbers are 2.4, and 2.9.

> "When you look at our education system, at the primary level a child has never interacted with a computer. At the secondary high school level, a child has not interacted with a computer. Then at the university, it's also possible that a student minimally interacts with computers."

Apart from the lack of digital skills, some people are hesitant to use digital technologies. There is some resistance to digitalisation among both teachers and students due to their perception that face-to-face teaching cannot be replaced by digital platforms. This is often strengthened by cultural aspects of communality that it is feared will be lost when providing digital education, and unfamiliarity with the tools at hand, as often there is not yet a common digital culture. Creating awareness about digitalisation and the various ways to implement it is therefore considered by participants to be essential.

Developing digital skills training for teachers/staff and students seems to be crucial for the (further) development of digitalisation. 92.9% of respondents to the survey found it important or very important to have more digital skills training for teachers/staff, and 94.7% of respondents found it important or very important to have more digital skills training for students. 96.1% indicated that, to further develop digitalisation, they would benefit to a high or very high degree from more digital skills training. A participant in the focus group said:

> "One of the solutions may be extensive training. So, students as well as teachers. Even the higher management needs to be trained on how to use these tools, and even the impact, the importance of these tools on the quality of education".

Curricula are currently delivered mainly through traditional face-to-face teaching and lecturers often use hard copies of educational resources. There are efforts to make a transition to digitised content, but this has not yet been fully integrated into the curricula. Participants mentioned that it is crucial to design curricula suited to the use of digital tools in their teaching. To be able to design such curricula, staff need to be trained accordingly:

> "Training is needed. Training on how to develop a curriculum which is suitable to this online training. We need training on how to manage that and everything related to this."

Participants also mentioned the importance of customised training in digital skills, adapted to the needs of the target group. Especially for TVET institutions, which have many courses with practical content, a participant mentioned that they are challenged when it comes to teaching practical skills:

> "It might be difficult to conduct courses which have field and lab practicals."

A participant mentioned a solution they had found to practical classes for agricultural students, through the development of a curriculum where students learn the theory online via the institution and gain practical knowledge on farms in their local area:

> "We only specialise on offering the foundation to have theoretical knowledge, but students could develop practical training particularly on farms. [...]. So, I believe that partnerships between the training institutions and the farming community is also very key for practical courses.

Insufficient governmental and institutional support

According to the focus group discussions, higher education institutions are struggling to financially support digitalisation due to limited funding from the government:

> "In our country, education is one of the least funded sectors, it is about 3% of the national budget. That's extremely low. So, universities get very little funding. In most cases, universities struggle to finance what they consider very important, critical services."

Funding and investment programmes are therefore highly needed. Participants mentioned that it could be effective to increase awareness about the benefits of digitalisation. For the development of digitalisation, it is crucial to receive both governmental and institutional support:

> "Universities collect money, and some money comes from the government. So, universities must prioritise. Some money should be used to build a strong digital system. But also, the government should prioritise by allocating specifically money targeted at building a digital system that supports digitalisation in higher education."

According to our survey responses, governmental and institutional support are crucial for the (further) development of digitalisation. 92.8% of respondents found supporting policies and/or funding from the government important or very important, 91.4% of respondents found support from their institution's management important or very important, and 90.9% found a clearer institutional vision of digitalisation in education important or very important. The focus group discussions echo this emphasis on the importance of support. Participants said that the largest part of their budget comes from the government, which as result has a significant influence in determining what is possible.

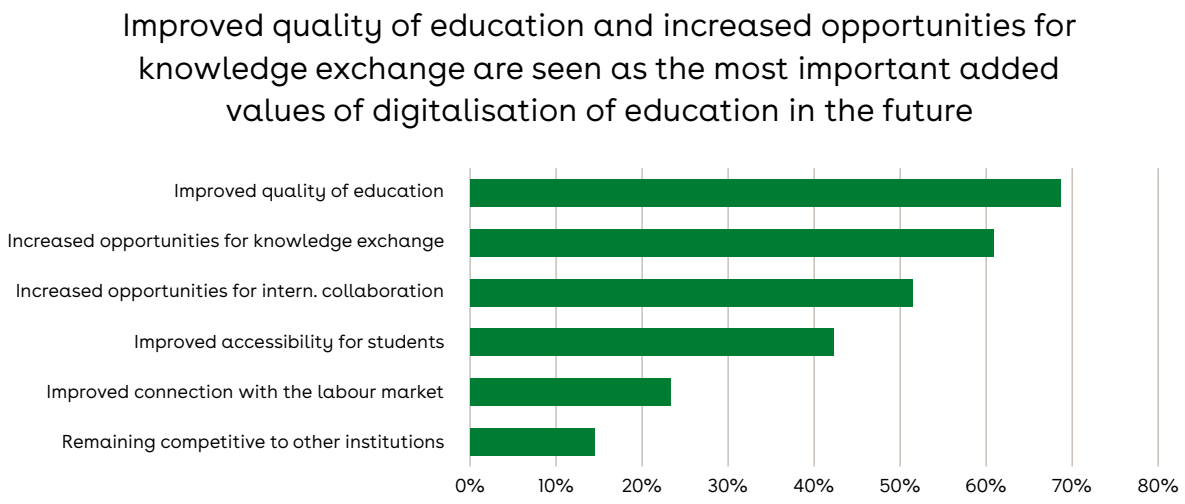
III. What do teachers and policy staff see as future opportunities and added value for digitalisation of tertiary education in East Africa?

Respondents say that the added value of digitalisation is mostly to improve quality of education and stimulate knowledge exchange and collaboration. It can also make education more accessible to students, better connected with the labour market, and more competitive. However, some potential risks should be kept in mind, especially with regard to security, improper use of technology, and (increasing) inequality.

Digitalisation can stimulate quality of education, knowledge exchange, and collaboration

We asked the respondents what, in their opinion, the most important added value of digitalisation of education in the future would be. They could choose a maximum of three options. 12 Respondents gave one vote, 8 respondents gave 2 votes and 182 remaining respondents gave all three votes, making a total of 574 'votes', which are visualised in figure 8. The option voted for the most is improved quality of education (68.6% chose this option), followed by increased opportunities for knowledge exchange (60.9%), increased opportunities for international collaboration (51.4%), and improved accessibility for students (42,3%).

Figure 8. *Respondents' answer to the question: What is in your opinion the most important added value of digitalisation of education in the future? (Choose a maximum of 3) (N = 202)*



According to participants in the focus group discussions, digitalisation of education can provide an opportunity for people and institutions from different parts of the world to connect, exchange knowledge, and collaborate. Students could expand their horizons by accessing a huge amount of knowledge and high-quality sources that are available worldwide:

> "It enables both students and the faculty to expand the scope of interaction for mutual benefit. It improves performance of students because they get materials from other accredited sources and hence when large classes limit their access to and interaction with the lecturer, they get alternative support for learning."

Digitalisation can also help improve the methods and quality of education by providing more flexibility and customised learning:

> "Digitalisation of education helps universities to modernise their teaching by customising the learning pace and teaching method according to student's need, choice, and interest and thus it increases the productivity and efficiency of students. It empowers students to gain more interest in education in the form of digital learning and expanding their horizons."

Digitalisation improves accessibility, connection with the labour market, and competitiveness

Digitalisation can help institutions to be more competitive, cost efficient, and able to reach a wider group of students. Participants mentioned that it is important to improve digitalisation (and the access and affordability of digitalisation) because it will reduce the running cost of their institution and enable more students to participate in education from the convenience of their home without spatial constraints:

> "Many students can be enrolled for the same class without limitation by the physical infrastructure. Also, education will become cheaper since many students do not have to rent [a room] away from home to study. Busy people will be able to study since they can access learning materials from anywhere and at any time."

An advantage of digitalisation is that it allows for learning to continue during crises such as a worldwide pandemic, due to the spatial flexibility it provides. As one participant mentioned, digitalisation is useful because *"it can ensure sustainability of the teaching-learning system even during difficult times and events such as COVID-19, conflicts, war, national crises, etc."*

Digitalisation can also help students get equipped with important skills that are useful in the labour market. Some benefits of digitalisation of education mentioned by respondents, are: *"application for the industry", "to fit with the modern digital world", and "encouraging students to be competitive by watching international students"*.

The potential risks of security issues and improper use of technology

When asked about the potential risks of digitalisation of education, participants provided answers relating to data privacy, cyber security, and fraudulent behaviour. Some example quotes are: *"Protecting intellectual property rights", "Protect the system against hackers", "Plagiarism", "Students' exposure to harmful content", "Students visiting unsafe sites on the internet during lessons"*.

Some survey respondents also fear that digital means such as social media can cause distraction among students and staff. Moreover, according to some survey respondents, students might not pay attention to and engage in the virtual class, and students may try to cheat during online exams.

Inequality and other potential risks

Respondents to the survey also referred to the risk of inequality since low-income students from rural areas might not be able to keep up with online learning due to poor infrastructure:

> "Those who cannot afford the technology might be left out in the learning process."

Other examples of risks include*: "Social isolation and loneliness among users", "Diminishing the ability to keep good handwriting and simple mental arithmetic.", "Hindering creativity of the users"*. Participants also mentioned some cultural concerns such as the potential decrease in indigenous knowledge and biodiversity.

Lastly, according to respondents there is the potential risk that digitalisation will not be successfully implemented mainly because of poor infrastructure and lack of policy support, funding, and training. Addressing these challenges is therefore crucial in order to make digitalisation a successful endeavour.

IV. In what way can cooperation between European and East African education institutions contribute to the further digitalisation of tertiary education in East Africa?

Cooperation between European and East African educational institutions can contribute to the further digitalisation of tertiary education through collaboration, the exchange of knowledge and experiences, financial support, and the improvement of facilities.

Knowledge exchange and funding opportunities

We asked participants in the focus group discussions about current and potential cooperation to enhance digitalisation and participants described current experiences with international cooperation. Currently, collaboration often takes the form of exchange programmes for students and staff or curriculum development. Participants suggested that lecturers from Europe could teach in East African institutions:

> "Professors come from Norway and give courses here for PhD students and they advise PhD students because we don't have many professors in our field. Master students are recruited and sent there to stay for a few months and get experience there and write their proposals. This is one example of collaboration."

Other ideas for cooperation were related to financial support and the improvement of infrastructure and equipment. For instance, participants mentioned that African institutions could benefit from sharing digital tools and platforms with European institutions such as having a shared subscription to Dropbox. Another participant mentioned that European institutions can provide the link between African institutions and international funders, such as the EU. Via this route, financial support for capacity-building projects and projects aimed at curriculum development could be beneficial:

> "I believe if institutions can come together in partnership with institutions like for example from Netherlands who have that kind of infrastructure, capacity building, as well as development of infrastructure, we can move faster."

Respondents filling in the survey also mentioned the need for cooperation with institutions and companies abroad for capacity building. They see opportunities for collaboration beyond public funders and for instance suggested that they would benefit from receiving equipment and financial support from big international IT companies (e.g. Huawei, Microsoft).

Finally, participants mentioned sustainability as an important condition of collaboration between European and East African institutions*: "I want the collaboration to be sustainable. [...] our condition should be sustainable, and we should have to see the output, the output should be seen. So, in that way, it may bring a change."*

E. Conclusions

This study aimed to gain more insight into what is needed to support the further development of digitalisation of tertiary education in East Africa. Our focus countries were Kenya, Tanzania, Ethiopia, and Uganda. We specifically looked at the experiences of teachers and policy staff working at tertiary education institutions in these four countries. We asked them about the current state of digitalisation and what they see as the challenges, needs, and possible solutions. Moreover, we asked them what they saw as future opportunities and the role of (international) cooperation. We discuss the main conclusions.

The results show that digitalisation is a relatively high policy priority at education institutions in all four countries, pushed significantly by the worldwide education lockdowns due to COVID-19. The current practice of digitalisation, however, is limited and mostly at a basic level. The policy analysis showed that the development of national policies on digitalisation in education is also at an early stage, meaning that the effects of these policies will likely not yet be experienced and implemented in practice.

In general, the quality and level of digitalisation in the four countries is limited, but varies widely between urban and rural areas within each country. In rural areas, there is often no connectivity, or even electricity, and while there may be broadband available, reliability is low and/or the price for usage is high. The challenges around access and connectivity in the region translate to limited infrastructure within educational institutions. Part of the reason for this is that government investment in (digitalisation of) education is still quite low. Nonetheless, all four countries are making some efforts towards digitalising education, at least in the form of national strategies. The many infrastructure challenges, however, result in unequal access to reliable internet and equipment (software and hardware), especially among students.

Besides this digital divide in terms of access, the policy analysis indicated a digital divide in terms of skills. Many students and teachers have limited or no digital skills to make use of available technologies. This means that investments in infrastructure will not be enough to close the gap, as additional awareness raising and skills training are needed for those lagging behind. Participants confirmed this when they described that both students and (to a lesser extent) teachers often lack the digital skills necessary to use technology and/or they hesitate to do so.

In daily practice, education institutions and their policy and teaching staff are working to find practical solutions to these challenges and to increase their digital service level for students, without losing sight of the major issue of inclusion. Example of such initiatives by institutions are digitising educational materials and libraries, implementing Open Distance and eLearning, using social media platforms, training teachers, and lobbying within their governments for specific funding for students' access to digital devices.

The teachers and policy staff who participated in this research feel that digitalisation can improve the quality of education, stimulate knowledge exchange, and create opportunities for (international) collaboration. Additionally, it could contribute to connecting education with the labour market and increase the accessibility of education for students. However, some

potential risks of digitalisation are security issues, improper use of technology, and being excluded from the learning process due to access or skills gaps. Practical implications for teachers and policy staff are listed in Appendix 4.

Cooperation between European and (East) African education institutions could support the enhancement of digitalisation, mainly through financial support, exchanging staff and students, exchanging knowledge and experiences, joint development of (digital) curricula, and the improvement of infrastructure and equipment.

Implications for European-African cooperation

The results of this study indicate that there is a need to further digitalise the East African educational system and point to the possible value of European-African cooperation in order to achieve this goal. Based on the results of this study, we discuss several conditions for digitalisation initiatives in East African education to be successful and equitable. In short, initiatives that aim at supporting digitalisation in East Africa should:

4. Digitalise with a purpose - Focus on the learning goals.
5. Ensure inclusive learning - Close the gap in educational opportunities.
6. Take an integral approach - Build infrastructure, digital skills and awareness.
7. Meet teachers where they are at - Enhance teacher engagement.
8. Utilise partnerships - Leverage shared challenges and goals.

Digitalise with a purpose - Focus on the learning goals

In order for digitalisation to increase the quality of education, it is essential to digitalise with a purpose and let the learning goals inform which digital tools to use. When implementing digital tools, there is a risk of losing sight of what the intended learning goals are. Given the enormous range of digital tools available, choosing the specific tools that support your goals will prevent ineffective investments of funds and capacity.

Digitalisation is perceived as a high policy priority, as reported by the majority of the teachers and policy staff in this study. Improved quality of education was mentioned most often as an important added value of digitalisation in the future, followed by increased opportunities for knowledge exchange and international collaboration.

However, the fact that many agree on the potential of digitalisation is no guarantee that digitalisation will work towards the learning goals that are aspired to. With COVID-19 focusing so much urgent attention on digitalisation, there is a risk of moving quickly to implement digital tools that may not be the most beneficial given the desired learning outcomes, or that may not be fully accessible for all students. Institutions making (sometimes large) investments in digital systems and tools should do so with a clear vision of the end goal in mind, to avoid a situation in which investments lead to none of the intended effects, or even worse, have a negative impact on educational quality. As pointed out by the World Bank, the number one principle for developing technology in education is to ask 'why?'[34].

Ensure inclusive learning - Close the gap in educational opportunities

Next to improving educational quality, another value of digitalisation mentioned by teachers and policy staff is its potential for making education more accessible. However, digitalisation will not automatically lead to better accessibility. On the contrary, the reliance on digital tools and infrastructure can result in some students not being able to participate at all. Without careful implementation, digitalisation will widen the gaps in educational opportunities.

Right now, Africa is the least connected continent globally. Efforts focused on supporting digitalisation of the African continent are therefore one of the most impactful ways to work towards more equitable educational opportunities on a global scale. Similarly, resources supporting digitalisation on a national scale should be dedicated first and foremost to institutions, geographic locations, and students that are in the early stages of digitalisation.

The type of institutions that receive support in their digitalisation efforts should be considered carefully. It is tempting to implement initiatives at institutions that have already taken some steps towards digitalising their education. However, these initiatives may reinforce local inequalities instead of closing the digital access and skills gaps. Moreover, piloting an approach for digitalising education at institutions that have a basic level of digitalisation already in place will be likely to fail in contexts where these requirements are not met. As noted by the World Bank[35], *"if it (the technology, the model, the approach) works in this sort of privileged environment, success may be a product of a number of factors that don't apply in other, less advantaged places*".

On an institutional level, digitalisation initiatives that focus on areas that are the least connected will lead to the biggest effect in terms of providing more equitable opportunities. This means that in East Africa, the focus should be on rural vocational education. TVET institutions in rural areas are serving young people for whom digitalisation efforts offer enhanced opportunities to build their skills and thereby contribute meaningfully to developing their local communities.

On a student level, it is a daily challenge to provide all students with opportunities for (digital) learning when access and skill levels vary so widely between students. In order for initiatives to improve the inclusiveness of education, specific support for disadvantaged students such as students from low socioeconomic backgrounds or students with disabilities, can boost accessibility.

Take an integral approach - Build infrastructure, digital skills, and awareness

The most advanced infrastructure is useless without teachers and students who have sufficient digital skills and the willingness to use it to its full potential. However, focussing on developing digital skills won't work if there is insufficient and unreliable infrastructure. Additionally, there is a risk of forgetting about social and cultural factors that can cause resistance to digitalisation. An integral approach is needed whereby infrastructure, digital skills, and awareness are addressed simultaneously.

Many African countries have been developing digitalisation strategies, including for education, or with education as a component of their digital economy strategy. Especially with the COVID-19 crisis, policy staff at institutions are very aware of the importance of digitalising their education and are making plans accordingly. However, without sufficient national infrastructure such plans are unlikely to be implemented in a sustainable way. Only when using an integral approach, stimulating infrastructure, digital skills, and awareness on a policy and teaching practice level, can digitalisation initiatives improve the quality and accessibility of education in East Africa.

Furthermore, the results of this study show that teachers and students need guidance in developing digital skills (for example, regarding online privacy and personal data security). Teachers benefit most from increased digital skills training and an online teacher platform to exchange practices and ideas. At the same time, teachers and policy staff stressed the importance of better IT infrastructure and facilities. As pointed out by a respondent in one of the focus group sessions, *"We are moving at the pace of our structures"*. Without the infrastructure being present in a reliable way, it will not be very attractive for teaching staff to (further) digitalise their teaching, as the challenges remain too big to fully leverage digital education.

Teachers and policy staff in this study stressed the importance of educating and training people. Teachers - and students - should be able to make use of new technologies and should see the benefits of these technologies. For some this may come relatively easily, however, a large group of teachers and students will need more support. Raising awareness and capacity building, or *"re-skilling"* teaching staff, are high on the priority list for many institutions.

Meet teachers where they are at - Enhance teacher engagement

Teachers are a crucial asset in quality education and thus a teacher's engagement in student learning through digitalisation is an essential part of transforming education. On a practical level, many teachers are already thinking about ways to digitalise. Initiatives supporting digitalisation should build on those existing local initiatives and experiences and should consider the hesitations of others.

When engaging teachers, it is important to meet them where they are at in their daily practice; at their experience level in class, preparing lectures and communicating and guiding students. This can be achieved, given sufficient time and attention, by conducting a context and needs analysis. As the World Bank states in their principles for technology in education[34], *"technology should enhance teacher engagement with students through improved access to content, data and networks, helping teachers better support student learning"*. Engaging teachers in their work to facilitate student learning should be the starting point.

Factors that influence teacher engagement may be cultural, such as resistance due to more communal cultural norms as opposed to individual digital learning, or even personal, such as hesitations and insecurities, or being unfamiliar with the technology at hand. Another potential barrier to teacher engagement that was mentioned is generational differences: especially older teachers and staff may be unaware or unable to make effective use of digital technologies in teaching.

Capacity building, or '*re-skilling*' as participants named it, is necessary to ensure the engagement of all teaching staff at institutions. National developments, such as governmental funding programmes in education as a result of their national digitalisation strategies, as well as local initiatives supporting digital education, should be leveraged to support teaching practices.

Additionally, teachers may benefit from sharing experiences and from the leadership of fellow teachers who have gained more experience and expertise in digital education. Within institutions, support groups or communities of practice could create a space for teachers to engage and be motivated to experiment in their teaching practice, or even share and debate their concerns.

Utilise partnerships - Leverage shared challenges and goals

One way to enhance digitalisation in Africa is through partnerships. The results of this study show the potential of European-African partnerships. Regional and local partnerships could also be beneficial to African institutions in terms of providing education, sharing resources and experiences, and joining forces to apply for funding through international partnerships. To increase investment, mainly in infrastructure, public-private partnerships should be considered as well.

While EU-African partnerships have great potential, they should be executed with great care, taking into account the historical context and acknowledging the unequal starting points in the collaboration. As we noted at the start of this research, the European-African relationship has been built upon years of colonisation, imperialism, and injustice. New partnerships and initiatives should be mindful of these relationships and prevent the predominance of European values and ideas over local expertise and needs. The differences between the European experience (the most connected continent) and the African experience (the least connected continent) are large, not to mention the differences in education systems, knowledge, cultural values and context. In European-African partnerships, it is crucial to collaborate at "eye-level", meaning that the way in which each partner will benefit from the partnership is completely transparent. Also, amplifying the voice of the African partners (still often the non-funding partners) is important, to ensure they are not overruled by the investing party.

Apart from European-African collaborations, local opportunities for collaboration should be explored. Participants mentioned collaborations with institutions in their proximity, and one example was given of providing education in collaboration with local farmers. So far, we have not come across many regional collaborations within East Africa. Policy staff in this study expressed their tendency to first focus on the national and local level before collaborating within the region. However, intra-African collaboration could have great potential, especially, since we found that the practical challenges experienced are very similar across the participants from all four countries. Regional collaborations could provide scaling benefits and reduce costs for individual institutions and national governments.

Public-private partnerships could potentially facilitate such developments, allowing local companies to expand and educational institutions to pioneer. Furthermore, private partners may be able to speed up and increase investments in infrastructure. Importantly, this should align with the existing national strategies and be facilitated by national governments through regulation.

HOW TO DIGITALISE YOUR EDUCATION PRACTICE

4 TIPS FOR TEACHERS

1. Choose function over form
2. Increase access through a variety of tools
3. Connect and find support
4. Encourage students to experiment

Function over form

- Choose digital tools based on your learning goals
- Use social media platforms for communication and guidance of students
- Use tools integrated in the curriculum design and linked to your students' personal accounts for knowledge transfer

Use a variety of tools

- Leverage digital tools that are available at no financial cost (but be mindful about privacy and data protection)
- Ensure digital tools and materials are suitable for mobile phones, as there is better access to phones over computers
- Choose 'light' educational content that does not require much data use
- Provide multiple content types; online video, online document, and hard copy. This way, it is more likely that all students will be able to access the content

Connect and find support

- Find colleagues with more experience to share their good practices.
- Collaborate in a community of practice to increase your skills and learn from each other.
- Communicate to your institution about challenges

Encourage students to experiment

- Students learn quickly by trial and error: a useful skill in their future lives and careers
- Experimentation with digital tools teaches students important digital skills
- Additional benefit: Less unrealistic expectations that the teacher knows all of the technological tools and possibilities

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HOW TO DIGITALISE YOUR INSTITUTION

4 TIPS FOR POLICY STAFF

1. Find ways to provide technical assistance
2. Connect your teaching staff
3. Collaborate with other institutions
4. Explore the private sector

Provide technical assistance

- Let early adopters dedicate a couple of hours a week to train and assist their colleagues.
- Teacher-champions set a brilliant example and can inspire other teachers to advance in using digital tools in their classroom.
- Pay attention to training teachers and students how to protect themselves from spamming, hacking and fishing attempts.

Connect your teaching staff

- Create Communities of Practice around digitalisation where teachers can connect, share experiences, tips, and tricks, and to support each other.
- Combine such community with other support services provided by the institution such as ICT support or digital skills training.
- Have teachers join online peer-groups to connect and find support.

Collaborate with other institutions

- Teachers and policy staff in different countries and at different institutions often face similar challenges when it comes to implementing technology.
- Do not try to reinvent the wheel all by yourself but get together and find solutions collaboratively with institutions within your country and the African continent.
- Explore joint investment in good working systems.

Explore the private sector

- Explore whether telecom providers such as Safaricom and Google may be willing to support educational initiatives for the public good.
- Communicate how such support initiatives are beneficial to these providers as such initiatives will make the next generation of consumers familiar with their products.
- Be aware of the risks related to engaging the private sector in education and remain aware of the goal of education to educate productive and responsible citizens.

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Appendix 1: Survey questions

1. **Which country do you currently work in?**
   - Kenya
   - Tanzania
   - Uganda
   - Ethiopia
   - Other country

2. **Choose the institution where you work the most hours. Throughout the survey we will refer to this institution as "your institution".**
   - Vocational/Technical education institution
   - Public university (or college)
   - Private university (or college)
   - Other (please specify)

3. **What is your main role in that employment?**
   - Professor
   - Lecturer or teacher
   - Policy officer
   - Project coordinator
   - Other staff member
   - Other (please specify)

4. **In what geographical region is your institution located?**
   - Urban area
   - Rural area

5. **What is your age? (drop-down menu)**

6. **What is the name of your institution? (optional) Your answer will be confidential and not be used for anything other than defining the spread of the respondents.**

7. **To what extent is digitalisation of education* a policy priority for your institution (compared to other possible priorities, such as PR and promotion of the institution, facilities, and international cooperation)?**
   - Not a priority
   - Low priority
   - Medium priority
   - High priority
   - Highest priority
   - Do not know

8. **To what extent do you agree with the following statements about your institution**? (Options for each statement: Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree, Do not know)
   1. Digitalisation is included in the vision, mission and/or strategy
   2. Digitalisation is commonly used in the teaching practices
   3. Digitalisation is supported financially
   4. The buildings are designed to support the use of digital technologies (e.g. internet room, good Wi-Fi and computers)
   5. Experimentation with implementing digitalisation is encouraged

9. **Name one highlight (good example) of digitalisation at your institution. (optional)**

10. **What forms of digital education are currently being applied by the teachers at your institution? (select all that apply)**
    - Pre-recorded PowerPoint presentations or videos
    - Online seminars or lectures
    - Education platforms such as Moodle, Blackboard etc.
    - Forms of blended learning (partly physical/partly online)
    - Online collaborations (with other institutions, nationally or internationally)
    - Virtual /Augmented Reality (using virtual reality glasses/headset)
    - Learning analytics (collecting data on student progress)
    - Gamification (digital educational games)
    - Adaptive learning technology (online learning platforms that adjust to the needs of students)
    - Use of mobile phones and apps such as Kahoot etc.
    - Other (please specify)
    - None of the above

11. **On average, and during this educational year, how often do** teachers **at your institution have access to the following?** (Options: Never, Rarely, Sometimes, Often, Always, Do not know/not applicable)
    1. A computer/laptop
    2. A smartphone
    3. Reliable internet connection
    4. Electricity
    5. Required software and programmes
    6. Required additional hardware such as headphones, microphone and a webcam

12. **On average, and during this educational year, how often do** your students **have access to the following?** (Options: Never, Rarely, Sometimes, Often, Always, Do not know/not applicable)
    1. A computer/laptop
    2. A smartphone
    3. Reliable internet connection
    4. Electricity
    5. Required software and programmes
    6. Required additional hardware such as headphones, microphone and a webcam

13. **On average, to what extent are teachers at your institution competent in the following digital skills?** (Options: Not at all competent, Not very competent, Moderately competent, Competent, Very competent, Do not know/not applicable)
    1. Browsing, searching, filtering and judging the relevance of online information
    2. Communicating and collaborating through digital channels (e.g. education platforms or social media)
    3. Creating digital content such as video's and webpages
    4. Protecting devices, content, personal data and privacy in digital environments
    5. Identifying needs and resolving technical problems in digital environments

14. **On average, to what extent are your students competent in the following digital skills**? (Options: Not at all competent, Not very competent, Moderately competent, Competent, Very competent, Do not know/not applicable)
    1. Browsing, searching, filtering and judging the relevance of online information
    2. Communicating and collaborating through digital channels (e.g. education platforms or social media)
    3. Creating digital content such as video's and webpages
    4. Protecting devices, content, personal data and privacy in digital environments
    5. Identifying needs and resolving technical problems in digital environments

15. **How often do teachers at your institution experience the following challenges when implementing digital education?** (Options: Never, Rarely, Sometimes, Often, Always, Do not know/not applicable)
    1. Unreliable internet connection/Wi-Fi at your institution
    2. Unreliable internet connection/Wi-Fi at home
    3. Access to hardware (computer, smartphone) at your institution
    4. Access to hardware (computer, smartphone) at home
    5. Insecurity or lack of digital skills (knowledge, competencies)
    6. Lacking technical support at the institution
    7. Lacking digital skills of students
    8. Students not having access to hardware/reliable internet

16. **Do teachers at your institution experience any other challenges when implementing digital education?**

17. **How relatively important are the following in the (further) development of digitalisation at your institution?** (Options: Not important, Slightly important, Moderately important, Important, Very important, Do not know/not applicable)
    1. Better IT infrastructure/facilities
    2. More support from your institution's management
    3. Clearer institutional vision on digitalisation in education
    4. More supporting policies and/or funding from the government
    5. More digital skills training for teachers/staff
    6. More digital skills training for students
    7. More local cooperation with other educational institutions
    8. More international cooperation with other education institutions
    9. Other (please specify)

18. **What collaboration opportunities do you see in order to enhance digitalisation at your institution? And with whom? (optional)**

19. **To (further) develop digitalisation in my teaching, I would benefit from…** (Options: Not at all, Some degree, Moderate degree, High degree, Very high degree, Do not know/not applicable)
    1. Better IT infrastructure or facilities
    2. More technical support
    3. Better access to online articles and publications
    4. More digital skills training
    5. Online teacher platform to exchange practices and ideas

20. **What is in your opinion the most important added value of digitalising education in the future? (Choose a maximum of 3)**
    - o Improved quality of education
    - o Improved connection with the labour market
    - o Improved accessibility for students
    - o Remaining competitive to other institutions
    - o Increased opportunities for knowledge exchange
    - o Increased opportunities for international collaboration
    - o Other (please specify)

21. **Please elaborate on what you think is the most important value of digitalisation. (optional)**

22. **What do you see as an important risk or consideration when implementing digitalisation in education? (optional)**

23. **As a last question, if you could choose one thing that would help you implement digitalisation at your institution starting tomorrow, what would that be?**

Appendix 2: Consent form – focus groups

In this form, we ask you about your consent and contact details to provide you with an airtime/data allowance.

Purpose of the study

The aim of this research is to investigate the current situation, needs and opportunities in digitalisation of education in East Africa and formulate policy recommendations. We believe that you can help us by telling us more about your experiences and ideas from your everyday practice.

Procedure

The focus group discussion will be held with 5-6 other participants with similar roles in education. We will ask you a maximum of 6 questions about digitalisation of education at your institution and give you time to share your experience and have a discussion with the co-participants about the topic. The topics are divided into three main parts:

1. Current situation (types of digitalisation and digital skills)
2. Challenges, needs, and strategies to address them
3. Future perspectives (ideas and opportunities for collaboration)

We will ask you to share your personal experiences, practices or stories. However, you do not have to share any information that you are not comfortable sharing.

There will be a moderator guiding the discussion and a co-facilitator making notes and supporting the session. We may interrupt the conversation for clarification purposes and will invite all participants to equally participate. You can use the "raise hand" function if you would like to speak to prevent interruptions. The chat function will be enabled for any technical questions or any short additions to the ongoing discussion.

Confidentiality

Your participation is anonymous. Nothing that you tell us will be attributed to you by your name or the name of your institution. No individual or institution names will be used in summary reports. We will anonymise all answers given, and names/titles mentioned.

We ask you and all other participants not to talk to people outside the group about what was said in the group. We will, in other words, ask each of you to keep what was said in the session confidential.

The entire discussion will be recorded solely for analytical purpose. After the project is completed, the recordings will be deleted. The information recorded is confidential, and no one else except the researchers will have access to the recordings.

By ticking this box, you agree that you are informed and that you give your consent. *

☐ Yes, I give my consent to fully participate in the focus group discussion.

Internet reimbursement
You will be reimbursed for your internet usage through an Airtime Top Up via WorldRemit. We would like to make the transfer before the focus group discussion starts. You will receive a notification on your mobile phone that your airtime has been topped up. This way, you can use your internet data (hotspot) during the focus group discussion, if necessary.

To be able to make the transfer we will need the information below. Please note that also this information remains confidential and will not be used for any other purpose.

Full name:

Mobile number:

City:

Appendix 3: Focus group protocol

FOCUS GROUP PROTOCOL

- Moderator (1)
- Co-facilitator (1)
- Participants (4-6 people)
- Duration: 1,5 hours

Outline:

- Welcome! We are very happy with your presence here today and your participation in our research project on digitalisation. Your insights will greatly benefit the relevance of the study.
- We will let all of you introduce yourself before we start the group discussion. But first, we would like to introduce ourselves and explain the structure of the meeting.
- So why this study? In collaboration with the British Council, we wish to explore policy recommendations and possibilities for future European-African collaboration on digitalisation.
- You have been asked to participate in this focus group to help us understand what the current status is of digitalisation in practice, what are challenges and needs of professionals working at education institutions, and what are the future expectations for digitalisation?
- The group discussion is scheduled to last approximately 1 to 1,5 hours.
- First, we would like to ask you about your experiences and secondly, about your ideas for future collaborations.
- We will have a short break in the middle.
- We hope that everybody has completed the consent form. If not, you may still do so after the session. This form is also needed to be able to compensate you for your data usage by topping up your airtime.
- The moderator and co-facilitator will take notes during the discussion to be able to ask for clarifications when needed or to summarise the discussion.

Start presentation PPT

- Ground rules and suggestions for participation
- Opening question

SCHEDULE:

1. **Welcome and ground rules** (10 min)
2. **Part 1: Participants introduction** (10 min)
   - Each participant shares:
     1. Name, institution and role/function
     2. How digitalised is your institution? Choose a category
3. **Part 2: Current experiences, challenges and needs** (30 min)
4. **Break**: 5-10 min
5. **Part 3: Future perspectives** (20 min)
6. **Closure** (10 min)
   - Any final remarks or thoughts?
   - Close the focus group discussion: thank participants, give them contact information for further follow up, explain how we will share the results
   - Community of Practice: interest and application
   - Survey: could you share?

Appendix 4: Recommendations for teachers and policy staff

This study brought out insights and information about digitalisation on a practical level. Following our vision and positionality statement that this study should not only benefit the initiating parties, but should also benefit the study participants - in our case teachers and policy staff working at tertiary education institutions - we use the results and conclusions of our study to discuss suggestions and recommendations for educational professionals, listed here below.

Furthermore, the **Community of Practice** that was started during this study is still open for participation. The Community of Practice is recommended for those who are interested in joining the conversation among peer professionals in East African tertiary education and remaining informed on possible follow-up initiatives as a result of this study.

Suggestions for *teachers*

The three main ways in which teachers reported using technology in their practice are 1) communicating with and guiding their students, b) knowledge transfer and providing resources, and 3) examination. Each of these functions can be performed with different digital tools and each has its specific challenges. In order to digitalise education and benefit student learning, teachers should pay attention to the following:

1. Choose function over form.

The learning goals – the purpose of the curriculum or your specific activity - should be the starting point from which you choose the form. This means that when choosing digital tools, your goals should be the determining factor. Digital tools should not be applied purely for the sake of digitalising, but should always fit the intended learning goals. For instance, for communication and guidance of students, there are many accessible social media platforms available. For knowledge transfer, you may need to use tools that are integrated in the curriculum design at your institution and that are linked to your students' personal accounts. While it may be tempting to use digital tools, implementing them without a clear goal in mind could diminish educational quality rather than improving it.

2. Increase access through a variety of (digital) tools

This study showed that digital infrastructure is often still lacking, especially among students. This is often due to issues of reliability and affordability. If possible, choose digital tools that are available at no financial cost and accessible to all students. Participants mentioned that teaching staff are using social media channels such as WhatsApp for teaching and knowledge transfer. Teachers should be tuning in to the students' capacity to access the educational materials. Students who don't have the required resources might not speak up about it. Digitalisation can add to educational quality but must never compromise accessibility. Students are likely to have better access to a phone than to a computer. Educational content should be adapted so that it is accessible through mobile phones and should be "light" to download, so as not to use up students' data bundles. Another way to make sure digitalisation does not threaten accessibility is by providing the educational content in multiple ways. For example, teachers can allow students to choose between watching a video online, reading an online document, or receiving a hard copy. In this way, it is more likely that all students will be able to access the content.

3. Encourage students to experiment themselves

Technologies are developing quickly. Teachers cannot always be expected to be aware of the latest tools or know how to use them. Encourage your students to research and experiment with the technology themselves. This reduces the unrealistic expectation that the teacher knows all of the technological tools and possibilities. At the same time, the opportunity for experimentation teaches students important digital skills and additionally they learn quickly by trial and error. Especially since technology is developing so quickly, this is a skill that will prove itself useful in their future lives and careers.

4. Connect and find support

As a teacher your time is often limited, and it may not be at the top of your to-do list to explore new technologies for your teaching. Therefore, it would help to make use of each other's experience and expertise as much as possible. Identify colleagues who are active with digital education and who could support you in your practice. For example, start a peer-group, such as a Community of Practice, within your education institution to strengthen the implementation and learning around digitalisation. Ensure that you communicate with your colleagues about challenges and good practices to increase engagement.

Suggestions for *policy staff*

This study also resulted in recommendations for policy staff at tertiary education institutions regarding their work to support the teaching and education quality at their institutions through policies and action.

1. Find ways to provide technical assistance

The lack of technical assistance was described as one of the biggest obstacles for teachers to digitalise their education. There is a shortage of ICT staff at institutions who are able to help teachers and students with using the technology that is available. Often the ICT assistance that is provided is overcrowded and cannot meet the demand.

While ICT staff is the optimal way to provide technical assistance to teachers, this resource is expensive. A cheaper way to increase the level of technical know-how is to let teachers educate each other. Often, there are some teachers who are early adaptors of new technologies. Find out whether these teachers can dedicate a couple of hours a week to train and assist their colleagues. Such teacher-champions set a brilliant example and can inspire other teachers to advance in using digital tools in their classroom.

Not only are technical assistance and digital skills training for teachers important to advance education, it is also necessary to ensure digital safety for the students and teachers at the institution. From our survey, it became clear that students and teachers often lack skills when it comes to online privacy and personal data security. Developing skills and awareness in this domain is essential to protect students and teachers from spamming, hacking and fishing attempts.

2. Connect your teaching staff

Communities of Practice around digitalisation can allow teachers to connect, share experiences, tips, and tricks, and to support each other. Such professional development groups are preferably organised by education institutions bringing their academic staff together. This can be combined with other support services provided by the institution such as ICT support or digital skills training. If such groups are lacking or not possible to organise, teachers can join online peer-groups to connect and find support.

3. Collaborate with other institutions

Our results show that within the four countries, teachers and policy staff have very similar experiences when it comes to implementing technology. Moreover, they face similar challenges and obstacles. Do not try to reinvent the wheel all by yourself but get together and find solutions collaboratively. Institutions can learn from shared experiences, both within their country and within the African continent. Moreover, when it comes to tools, collaborations allow for joint investment in good working systems.

4. Explore the private sector

There are risks related to engaging the private sector in education. The goal of education should always be to educate productive and responsible future citizens. However, when it comes to connectivity, the private sector can provide the boost that is so badly needed in education. Telecom providers such as Safaricom, Google, and Huawei may be willing to support educational initiatives for the public good. This is beneficial to them as such initiatives will make the next generation of consumers familiar with their products. At the same time, it can provide the necessary step to connect students to the internet, allowing them to gain access to a world of information and educational opportunities.

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