Creating digital content and delivering digital learning in African universities

Stories of innovation from Ghana, Kenya, and Nigeria

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Cover image: photos provided by the innovators featured in the report.

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1 Executive Summary

Digital learning can help open-up access, serve learners better and make HE more resilient

The potential for digital learning is significant. It offers the possibility to open-up access, make higher education systems more resilient, and to provide new modes of learning. Profiling 27 innovators in 15 universities across Ghana, Kenya and Nigeria, this report offers a snapshot of the innovation happening on campuses and in homes across the continent. It shows that change is possible and that talented and passionate academics are forging forwards.

Faculty in Ghana, Kenya and Nigeria are quietly innovating, often below the radar of their institutions and their colleagues, and frequently unsupported

Innovation exists on a spectrum. Many will look for new digital platforms and tools as evidence of innovation, but experimental shifts in teaching practice and creative use of available digital tools and content are important innovations in their own context and are meeting immediate learning needs.

Much is happening below the radar, and with limited recognition and support. Innovation is often an individual affair, under-funded and self-financed, and achieved through the tools at hand and through the skills and knowledge that individual academics teach themselves. In some cases, academics are using digital tools to create and author their own digital content; in others they are combining and repurposing these tools to reach their learners and share existing materials.

Innovators are committed, driven to solve problems, and invest their own time and resources

While each innovator is driven by different goals and needs, a commitment to their students and their profession, and an instinct to respond to new needs and demands, and to take opportunities to do things differently stands out. Many are driven both by a wish to serve their own students and to meet the wider social need to make higher education more accessible and relevant.

The pandemic has been a catalyst, but is not the only driver– lecturers seek to use digital tools to engage their students in learning

While the pandemic was a new impetus for many of the stories described here, it has not been the only driver of innovation. Existing concerns about engaging students in large classes and opening-up learning have inspired much innovation. Innovation is driven by academics who are passionate about teaching, want to reach their students better, and want to open-up access to learning, whenever and wherever they wish to learn.

Infrastructure, funding and skills are important but must be accompanied by efforts to build trust and to nurture open and collaborative approaches to truly transform learning

Academics encounter well-known barriers of infrastructure, skills, and finances, all of which are important and need to be addressed. These require greater investment and new policy responses, not least to ensure equity and quality. But policy responses must not stifle innovation through over-regulating what academics can do and restricting or discouraging their creativity.

More subtle, but no-less critical are issues of trust, and particularly the readiness to share ideas and content, and to adopt open licensing and open approaches which enable this. This was reflected in a reluctance to share stories in some cases, as well as concerns about intellectual property and ownership of the content that individuals create. This would seem to reflect wider concerns about who owns knowledge, and concerns within academic circles about the inequities of scholarly communication systems.

Leadership at all levels of higher education is needed to encourage change and to benefit from what digital learning can offer. Creating new systems of reward and recognition will be key.

Making the most of the opportunities that digital learning offers will not be easy. It will require investment and leadership. The potential of digital innovation is hampered by the ability to harness collective talent and expertise to achieve greater impact within the constraints of modest budgets and strained higher education systems. Reward and recognition are key – so that efforts to rethink and improve teaching, digital or otherwise, are celebrated and encouraged and attract comparable attention to research and publication.

2 Discovering innovators in the African HE system: our approach

2.1 Framing

Much has been written about technology in African higher education

Much has been written about the potential and impact of ICTs on teaching and learning in African higher education, and there have been significant investments to upgrade ICT infrastructure, connectivity and tools (such as learning management systems and digital repositories).There have also been significant efforts to introduce African educators and their students to digital content produced by others, such as Open Educational Resources (OERs) and Massive Open Online Courses (MOOCs).

The emphasis has been on tools and IT infrastructure

With respect to digital and technology-enhanced learning, studies have investigated online learning more broadly, including academic and student perceptions of e-learning environments,[1] learning management systems,[2] the availability and accessibility of digital resources,[3] and the necessary ICT infrastructure to enable digital and remote learning,[4] especially with respect to COVID-19.[5]

Content appears to be accessed from outside the continent

Existing work has also documented levels of awareness and use of digital content produced by others, including in the form of Open Educational Resources (OERs), and the existence of digital skills and literacies to access and use this content, and to evaluate digital information sources.[6] Nevertheless, much of the content that learners are understood to be using is produced outside of the continent, perhaps with the notable exception of content produced in South Africa,[7] and is hosted on global learning platforms, including US and European MOOC platforms.

The prevailing narrative is of consumption not creation

The prevailing narrative suggests that African academics are largely consumers of digital learning content and tools produced by others – well-known universities in the US and Europe, or in some cases private firms – but that they are not producers in their own right. As universities across the continent have rapidly pivoted to forms of online and remote learning to mitigate the impact of campus closures over the last 18 months, these issues have become ever more important.

Little is known about how content is developed in Africa

Much less is known about how African academics are creating and developing their own learning content. We know little about how much is being created, in what forms and by whom, and we know little about how it is being done, including the extent to which it is formalised and supported, through institutional policy and processes, as opposed to being an informal and individual endeavour.[8] With respect to the creation of digital content, the focus has predominantly been on research, through the publication of digital research data and outputs and other 'knowledge products'.[9]

We need to understand the human dimensions

Much work to explore the digital aspects of higher education has concentrated on the technologies that underpin it. We therefore set out to explore the human dimensions through which learning content is created: academics' understanding of this content;

[1] Tawiah et al., 'Review of E-Learning Environment at the Kwame Nkrumah University of Science and Technology, Ghana'.
[2] Biney, 'Experiences of Adult Learners on Using the Sakai Learning Management System for Learning in Ghana'; Unwin et al., 'Digital Learning Management Systems in Africa'.
[3] Pete et al., 'Differentiation in Access to, and the Use and Sharing of (Open) Educational Resources among Students and Lecturers at Technical and Comprehensive Ghanaian Universities'.
[4] Lwoga, 'Making Learning and Web 2.0 Technologies Work for Higher Learning Institutions in Africa'.
[5] eLearning Africa and EdTech Hub, 'The Effect of Covid-19 on Education in Africa and Its Implications for the Use of Technology: A Survey of the Experience and Opinions of Educators and Technology Specialists'.
[6] Wolfenden et al., 'Teacher Educators and OER in East Africa'; Cox and Trotter, 'An OER Framework, Heuristic and Lens'.
[7] Czerniewicz et al., 'OER in and as MOOCs'.
[8] Pallitt, 'Perspectives on Learning Design in African Higher Education'.
[9] Mwelwa et al., 'Developing Open Science in Africa'.

the practices and processes through which it is created, including familiarity with the concepts of learning or instructional design; familiarity and confidence in using different tools and approaches to produce content; the extent to which content is collaboratively developed with other educators or students; how this content is quality assured, curated and reviewed at institutional level; the degree to which it is openly licensed and deliberately shared within and beyond the institution; and how the production and use of digital content informs pedagogical strategies and approaches.

Getting beyond 'flagship' universities

Studies of this nature often concentrate on a smaller number of 'flagship' universities. But systems of higher education in all three countries are diverse, as well as highly inequitable. We have deliberately sought insights and views from both public and private universities, and from those in urban and rural institutions in each country.

2.2 Our aims

Our project had six objectives

1. To identify and document existing, less visible practices in the creation and use of digital learning content from across the higher education system in each country: to understand what content is being created, for what purpose, by whom and through what methods, in what form, and for whom.
2. To understand the opportunities and challenges encountered by the creators of this digital learning content: what individual, institutional, and wider system-level factors enable African academics to create and use digital learning content in their teaching or prevent them from doing so.
3. To understand the extent to which this content is formally incorporated into institutional learning collections, through review, quality assurance and accreditation, and through publication and hosting on institutional platforms.
4. To identify promising practices from these country studies, that have wider value for academics and universities in each country, as well as value to university educators and leaders across the continent, and value for the global higher education community.
5. To identify policies and processes which can enhance or hinder the development of digital learning content and recommendations for action which could facilitate wider replication.
6. To demonstrate these innovations in practice to African HE policy makers and leaders, and to HE policy makers and leaders from beyond Africa.

2.3 Defining our terms

Digital content

By digital learning content we mean any content that is: designed for use on computers, tablets or mobile phones; and is shared and accessed via websites, online learning platforms and repositories, smartphone apps, or is shared through other social media channels and groups such as WhatsApp, Signal, Telegram etc. Digital content could include material in audio or visual form – a digital document of any type, a video, an audio recording, an application (app).

Innovation

We understand innovation to be contextually dependent. We take it refer to any practices which are unusual or creative within their own national and institutional contexts.

By innovation we mean an idea that changes and impacts the way teachers teach and learners learn within a digital and country-specific context.

2.4 Methodology

Six-stage approach

The list which follows identifies the six key stages of our approach, each one designed to build progressively onto the previous one, culminating in the publication of the final report:

- Rapid review of the existing published and grey literature.
- Call for 'stories of innovation' – to identify interesting, innovative, useful digital content being created.
- 'Stories' shortlisted and the most interesting developed further through interviews (conducted online and recorded).
- Stories published online for wider viewing and further comments.
- Workshops to synthesise results, reflect on emerging findings, identify enablers and obstacles, co-produce recommendations.
- Final report and briefings.

The work was undertaken from February until the end of April 2021, with the final report drafted in May 2021.

Literature review

We undertook a rapid review at regional and country levels

We undertook a rapid literature review at regional and at country level. This review had three aims:

- To identify relevant policies and practices relevant to digital content creation in universities in our three case study countries.
- To provide a synthesis of high-level evidence available.
- To identify people involved in innovative digital content creation in universities.

Review question

Our overarching review question was:

What is the evidence on what digital learning content is being produced, and how it is being produced, within the higher education system in Ghana, Kenya and Nigeria?

Within that we sought to answer the following subsidiary questions:

- What evidence is there of policies and processes to enable and support this work?
- What evidence is there of programmes and people undertaking this work?

Rapid reviews are useful for generating synthesised knowledge based on a 'condensed' systematic review of existing evidence, occurring most often within a limited time span. This rapid review employed systematic review procedures (over a five-day period) and was conducted according to clearly defined inclusion criteria. The inclusion criteria for the study were twofold:

- The searches were country specific (i.e., Ghana, Kenya and Nigeria) to delimit the context.
- The literature was largely restricted to the past five years (2016-2021) in order to surface evidence of recent innovative practices

Searches focussed on digital content creation and innovation with seven (7) key words or phrases used including: 'Digital content', 'Digital tools', 'Digital platforms', 'Digital or eLearning, policies', 'Digital or eLearning, policies processes' 'Digital or eLearning programmes' and 'Digital content creation in universities'.

Sources used

Sources consulted included both published and grey literature (these are contained in Annex 1). Databases consulted were those available in the researchers' respective institutions, and included Scopus, Emerald Insight, ScienceDirect, Research4Life (AGORA, OARE, HINARI and ARDI) as well as the Electronic Thesis and Dissertation (ETDs) database, the Open Access Thesis and Dissertation (OATD) database, EBSCOhost, IEEE/IET Electronic Library, JSTOR, OECD Library, Open Edition Journals, Heine Online, Google Scholar, Scopus, Taylor & Francis Journals, Sage Journals.

Call for stories

To surface examples of innovative academic practices, the research team put out a call for stories of innovation to individuals identified through the literature review and through their own networks. The team adopted a snowball sampling approach to expand the number of potential contributors to the innovation stories. A short survey was developed and shared via Survey Monkey with potential innovators. The survey collected basic demographic data, and asked five questions:

- Whether they or their colleagues had developed digital learning content in the preceding five years.
- What content was created
- In what ways, if any, the content had benefited users
- The numbers reached by or who have accessed this content
- In what ways the content is considered innovative

Descriptions of the content were limited to a maximum of 300 words. From this longlist of 60 contributors a 28-person short list of the most innovative stories was identified.

Interviews

All those who were short-listed were interviewed in a one-hour session, to capture greater details of their innovation. Seven questions were asked:

- Describe the digital content you created.
- In what ways do you consider this content innovative?
- How important is this content to your university?
- To what extent would you say that your innovation has wider value for academics and universities?
- What are some of the policies and processes which you believe can enhance or hinder the development of digital learning content in your country or more broadly in Africa?
- What would be your top recommendations for actions which could facilitate wider replication?
- What measures have you put in place to ensure that the innovation is sustainable?

Publication of stories

All shortlisted stories were published on Medium (https://medium.com/digital-universities-in-africa), a publicly accessible platform, to make them widely visible and to enable review by peers, who were invited to comment on them.

Workshops

Two workshops were held as part of this project. Workshop one was with a sample of innovators. Its purpose was to:

- Review and reflect on the stories collected from the research undertaken on the creation of digital content in Ghana, Kenya and Nigeria.
- Reflect on and discuss how these approaches had supported teaching and learning in higher education.
- Identify what was important and promising about the practices that the stories describe, and how these practices could be better supported, so that they could be adopted more widely.

Workshop two brought together a group of senior academics, policy makers, the research team, and British Council representatives. Its purpose was similar to that of the first workshop, but was designed to extend the discussion to a wider and more senior group. It included reflections on possible recommendations emerging from the study.

From both workshops, a series of common themes emerged, some conclusions were drawn about the enablers of and obstacles to the creation of digital learning content, and a series of recommendations were formulated within the groups on how to enable the wider creation of quality digital learning content in Africa. The latter enabled a vision be articulated of what digital approaches could bring to teaching and learning in the three countries, and across the continent more widely.

3 Assessing the landscape of digital learning

The published literature is thin

Sources consulted included both published and grey literature.

Our regional review identified 12 relevant sources. Our country level reviews indicated limited published literature in the area of digital content creation, both in terms of documented institutional or national policy and individual and institutional practices.

In Kenya only five of 30 papers found were judged to be relevant and containing content related to the creation of digital content. In Ghana three of six papers were judged to be relevant and in Nigeria six of 12 documents were found to be relevant.

3.1 A regional view

Diverse practice but mainly from grey literature

Our regional review shows a diversity of practice relating to the creation of digital learning content in higher education across the continent. The majority of evidence of these activities came from grey literature, suggesting that these issues are under explored in academic publications.

Adapting and re-using content created elsewhere

There was evidence of universities adapting and re-using existing resources that had been developed by other institutions. For example, the University of Rwanda's Online/Blended Module Quality Review Rubric[10] and the University of Namibia's use of a training course for staff from Johns Hopkin's University.[11]

A mix of established practice and pandemic response

While some institutions with a longer history of digital learning display a robust strategic and policy response to the issues, for example, the Open University of Tanzania[12] and the University of Cape Town,[13] for other institutions practice seems to be an emergency remote teaching response to the needs created by the pandemic, such as the University of Namibia.[14]

Universities in Uganda, Tanzania and South Africa have created content

At Makerere University (Uganda), and Mzumbe University (Tanzania), there was evidence of internal activities to support the creation of digital learning content, as well as involvement of external projects and partners in providing digital learning courses.[15] There was evidence of academics creating open educational resources (OERs) in Tanzania and South Africa[16] and in small Commonwealth countries in Africa,[17] and of distance learning students across Southern African, studying through the University of South Africa, creating their own digital content through WhatsApp and other platforms.[18]

[10] UR eLearning Platform, 'Online/Blended Module Quality Review Rubric'.
[11] University of Namibia, 'Teaching Remotely'.
[12] Open University of Tanzania, 'Information and Communication Technology Policy'.
[13] UCT Centre for Innovation in Learning and Teaching, 'UCT Formal Online Education Project'.
[14] University of Namibia, 'Teaching Remotely'.
[15] Gupta et al., 'Lessons Learned from Implementing E-Learning for the Education of Health Professionals in Resource-Constrained Countries'; Ghasia et al., 'Reflection on E-Learning System of the Mzumbe University in Tanzania: Successes, Challenges and Way Forward'.
[16] Hoosen and Butcher, 'Understanding the Impact of OER: Achievements and Challenges'.
[17] Virtual University for Small States of the Commonwealth (VUSSC), 'Partnering with Institutions – VUSSC Connects with Courses'.
[18] Madge et al., '*WhatsApp* Use among African International Distance Education (IDE) Students'.

3.2 Ghana

Evidence on policy initiatives and ICT infrastructure. Little on content creation.

The review indicated that various policy initiatives have been put in place concerned with digital practices in teaching and learning, by the Government of Ghana through the Ministry of Education and by various academic institutions.[19] There was limited literature on digital content creation but some literature covering the provision of broader ICT infrastructure for teaching and learning and its impact on students.[20] While academics are known to be developing digital practices, evidence of this has yet to emerge through the published literature.

3.3 Kenya

Evidence on student perceptions of digital content. Little on content creation

Much of the literature covered student perceptions and attitudes towards digital content in teaching and learning, rather than discussing its creation, and it is therefore unclear if this is related to locally produced content, or content adopted from elsewhere.[21] The literature suggests that there has been a recent shift towards digitizing content to better meet learners' needs, and to optimize the use of technology for teaching and learning more broadly.[22] However, it appears that much of this activity is relatively invisible in the published literature.

3.4 Nigeria

Evidence of experimentation with digital tools and adaptation of content. Little on policy frameworks.

The review suggested that academics are experimenting with the tools available to them or modifying existing designs to create learning content and platforms.[23] Several papers are themed around awareness and perceptions of digital content, and the challenges of using it.[24] There is a paucity of research on institutional or national policy formulation or implementation for digital content creation, which is significant given the importance of policy in driving practice in HE.[25] There is little documentation on content creation using blogs, screencasts, podcasts, wikis, and other digital platforms.

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[19] Ministry of Education, 'ICT in Education Policy'; Edumadze and Owusu, 'Use of Information and Communication Technology for Teaching and Learning in Ghanaian Universities: Case of University of Cape Coast'.
[20] Dei, 'Deployment and Adoption of E-Learning Systems in Ghanaian Universities'; Adanu et al., 'Electronic Learning and Open Educational Resources in the Health Sciences in Ghana'.
[21] Mwaniki et al., 'Development of Interactive Online Learning Modules'.
[22] Nyerere, 'Open and Distance Learning in Kenya'; Mwaniki et al., 'Development of Interactive Online Learning Modules'; Oteri, 'The Application of IoT Layer One Based Mobile Labs in Engineering, Science and Technology Education'.
[23] Talib et al., 'Interactive Courseware as an Effective Strategy to Overcome Misconceptions in Acid-Base Chemistry'; Abubakar, Mustapha, and Raji, 'Development and Validation of E-Content in Teaching and Learning of Automobile Lighting System in Technical Colleges in Niger State, Nigeria'; Abdulrauf and Sulyman, 'Enhance Inclusive Learning System'.
[24] Marshall, 'MOOCs Have a Massive Potential Market in Africa'; Oladele and Modebelu, 'Lecturers' Perception of the Challenges of Development of Courseware for Open Distance Learning In Nigeria'; Eze et al., 'Factors Influencing the Use of E-Learning Facilities by Students in a Private Higher Education Institution (HEI) in a Developing Economy'; Agbu, 'OER and MOOCs at the National Open University of Nigeria | Teachonline.Ca'.
[25] Agbu, 'OER and MOOCs at the National Open University of Nigeria | Teachonline.Ca'; Agbu et al., 'The Best of Two Open Worlds at the National Open University of Nigeria'; Abubakar, Mustapha, and Raji, 'Development and Validation of E-Content in Teaching and Learning of Automobile Lighting System in Technical Colleges in Niger State, Nigeria'.

3.5 Themes identified from the review

Area	Theme	Source
Issues related to academic practice	Adaptation is required where existing methods of teaching and learning are no longer 'fit for purpose'.	Ahmed, 2020; Nyerere, 2016
	Instructional design processes are essential to quality content creation.	Abdulrauf and Sulyman, 2020; Abubakar, Mustapha and Raji, 2019; Talib et. al., 2018.
	Abstract concepts require simple, innovative and easily digestible presentations of learning material to ensure that learning outcomes are achieved.	Talib et. al., 2018; Abubakar, Mustapha & Raji, 2019.
	Using available tools to redesign and present learning content.	Ahmed, 2020.
	The use of a digital tools in delivering content can be as effective as traditional modes of conveying concepts.	Adanu et al, 2010; Ahmed, 2020; Oteri, 2020.
Institutional and national policy issues	Digital learning content is not widespread in its availability, institutional awareness or support.	Agbu et al., 2016; Agbu, 2018; Ministry of Education, Ghana, 2015; Nyerere, 2016.
	Developing institutional ICT and e-learning systems and policies are prerequisites for enabling digital content development.	Edumadze and Owusu, 2013; Oladele and Modebelu, 2017.
Processes that facilitate or limit the use and growth of digital content	Incentivisation of individual academics is a major factor in supporting digital content creation.	Nyerere 2016; Mwaniki, et al., 2016; Oladele and Modebelu 2017.
	Organisational factors can be as important as technological barriers to digital content creation.	Dei, 2018; Eze et al, 2020; Mwaniki et al., 2016.

4 Stories of innovation from Ghana, Kenya, and Nigeria

4.1 Summary of the stories

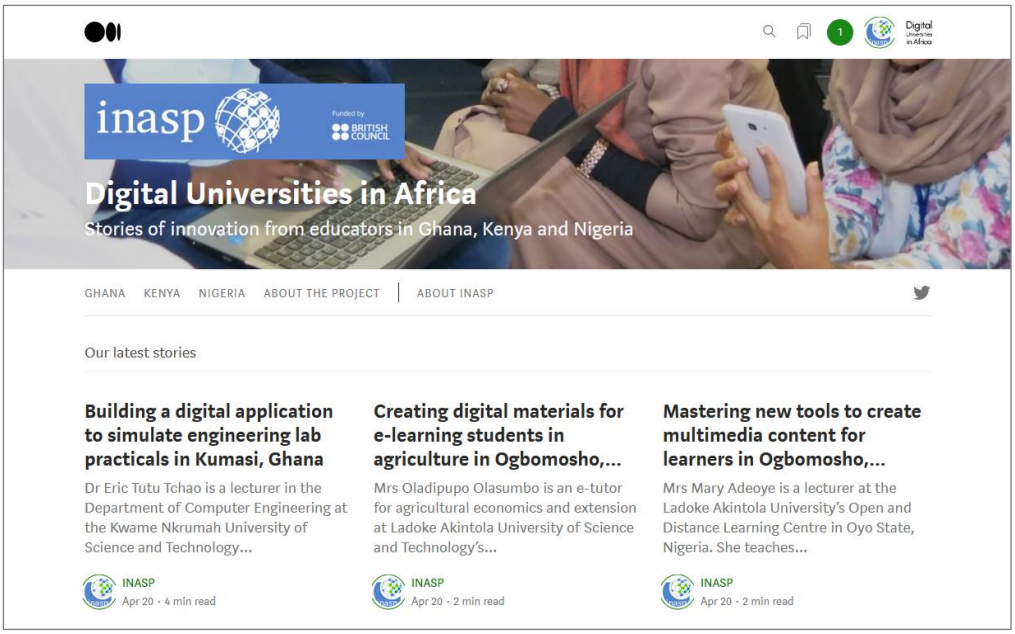
The context in which our stories were developed

27 stories of innovation were developed, covering 15 universities across Ghana, Kenya and Nigeria, and involving 26 individual academics: two individuals had each generated two innovations (their stories are merged below) and one innovation was generated by a team of two.

Eight innovators are women (three in Kenya, one in Ghana and four in Nigeria) and 19 are men. The difficulties locating innovators who were willing to share their stories, and further developing stories, as well as some issues of trust (see below) mean that the distribution by gender cannot be interpreted too firmly but does pose further questions about relative access to resources, tools or time to innovate in these ways.

A snowball sampling approach was used in identifying stories. Contributors were asked to identify other contributors.

Our stories were published online to enable wider access to our emerging findings and give innovators greater visibility



https://medium.com/digital-universities-in-africa

It is clear, given the institutions represented in our sample, that the work and practices of academics from many more universities are not captured by these stories. There are several reasons for this.

Despite the use of surveys and the snowballing approach used, it was often difficult to uncover work being done which was – by its nature – largely invisible to colleagues, and to those outside of the university.

While the stories we gathered were shared freely, with academics welcoming the chance to profile their work publicly, in some cases there was a notable reluctance to share stories and to participate in the project.

Understanding the reasons for this – beyond the pressures of time and workloads – is difficult, but in several instances the reluctance to participate seemed to be associated with concerns that the ownership of the innovation would be lost. In other

cases, it seemed to reflect broader issues of trust and openness, and the ability of researchers to persuade those who did not personally know them to participate.

The final sample for the study was therefore comprised of those academics who were known or otherwise identifiable, who were accessible, and who and made themselves available for discussion. Despite these limitations, and the notable concentration of stories within a single university in Ghana, we can learn much from these accounts, and hope by publishing and celebrating them, we can encourage others to give their own accounts and to add to the collection.

4.2 Introducing the innovators

Below we introduce our 26 innovators. The countries in which they work are indicated by flags on the left.

 Ghan  Kenya  Nigeria

Putting lectures online -mastering new tools to reach students as campuses closed

Dr Alex Kwarteng is a senior lecturer with the Department of Biochemistry and Biotechnology of the **Kwame Nkrumah University of Science and Technology** (KNUST). In the early stages of the COVID-19 pandemic, as universities closed, Dr Kwarteng needed to find a way for the students to get access to learning materials. Dr Kwarteng uses Zoom to record his lectures. To produce the lecture, he takes his notes, and incorporates cartoons and videos that he has found online to help him to explain a concept better or more quickly. He also uses Camtasia to film himself doing some of the practical demonstrations. Although students may not be able to replicate the practical at home, he hopes that it brings them closer to understanding what he is teaching in class.

Read more: *Putting lectures online – mastering new tools to reach students as campuses closed in Ghana*

Experimenting with digital tools to engage students in their learning

Dr Augustina Sylverken is a Senior Lecturer with the Department of Theoretical and Applied Biology of the **Kwame Nkrumah University of Science and Technology** (KNUST). Dr Sylverken uses Edmodo (an e-learning platform) to create and share lecture notes and uses tools such as Menitmeter and Kahoot (a game-based learning platform which enables participants to vote) to create exercises for the class, and to ask 'short-short questions' to check their understanding of key concepts. Students have been more responsive in lectures and have engaged in discussion. Dr Sylverken's exploration of online tools was prompted by her frustrations with the typical mode of teaching she encountered.

Read more: *Experimenting with digital tools to engage students in their learning in Kumasi, Ghana*

Interactive content gives art education students control over their own learning

Dr Harry Barton Essel is a senior lecturer with the Department of Educational Innovations at the **Kwame Nkrumah University of Science and Technology** (KNUST). He wanted to combine different media into an 'intelligent tutoring system' that would provide immediate feedback to learners. He uses Adobe Captivate to create interactive content, in a mobile ready format, to enable them to study at a pace that suits them best. The application allows a degree of interactivity to be introduced through programming. A programming language called ActionScripts allows Dr Essel to add additional functions which allow students to interact with content in simple ways. That might include an ability to select an answer to a question using a 'drag and drop' or 'click and reveal' function.

Read more: *Interactive content gives art education students control over their own learning in Kumasi, Ghana*

'Voice notes', screen recordings and finding the right platforms have helped to keep students learning

Dr Charles Apprey is a lecturer with the Department of Biochemistry at the **Kwame Nkrumah University of Science and Technology** (KNUST). When the pandemic forced the university to close the campus, Dr Apprey and his colleagues had to continue their teaching from home. He realised that his students lacked access to the university's Virtual Class. Instead, he started to explore how they could use WhatsApp to continue learning. Looking for a way to pre-record his lectures so he could share them with his students, he came across an application called Snagit, which allows him to capture screenshots and record video.

Read more: 'Voice notes', screen recordings and finding the right platforms have helped to keep students learning in Kumasi, Ghana

Passion to deliver and realising PowerPoint wasn't enough led to learning videos

Dr Henry Mensah is a senior lecturer with the Business School of the **Kwame Nkrumah University of Science and Technology** (KNUST). Dr Mensah started to use an application called Screencast-o-Matic, along with other software, to create videos on business ethics and law to present to his students. Getting the finished videos to students wasn't straightforward because of file sizes, so he had to break them apart, upload them to YouTube, and send links to his students.

***Read more:** Passion to deliver and realising PowerPoint wasn't enough led to learning videos in Kumasi, Ghana*

Using a learning management system to structure, distribute and disseminate learning materials

Dr Eric Opuku was until recently a lecturer in the Information Studies Department at the **University of Ghana** but has now moved to the Department of Computer Science at the **Kwame Nkrumah University of Science and Technology** (KNUST). The large number of students being taught on the department's programmes meant they needed a place where all learners could go to access materials. Dr Opoku has used Sakai to create content for courses in telecommunications and programming. First, he uses a storyboard application to create an overall structure for his content and to guide the learner, and then he uses presentation tools such as PowerPoint and drawing board tools to construct his materials and create graphics.

***Read more:** Using a learning management system to structure, distribute and disseminate learning materials in Legon, Ghana*

Building a digital application to simulate engineering lab practicals

Dr Eric Tutu Tchao is a lecturer in the Department of Computer Engineering at the **Kwame Nkrumah University of Science and Technology** (KNUST). Dr Tchao teaches basic electronics to different classes, including students from civil engineering, geomatics, and geological engineering. Most classes have over 200 students and all of them are required to undertake lab sessions. The electrical engineering labs only have around 15 computers, so it is difficult to accommodate classes of that size. Dr Tchao decided to change the way he was teaching the course. He thought it would be better if there was an online version of the labs, where the students could practice with a system. This is how the e-lab came into being. Dr Tchao built a JavaScript application which allows students to access practical experiments online, and which runs on a mobile device.

***Read more:** Building a digital application to simulate engineering lab practicals in Kumasi, Ghana*

Delivering lectures via YouTube to reach students when campuses closed

Professor Audrey Mbogho is an Associate Professor of Machine Learning in the Department of Computing at **University States International University-Africa**. When COVID-19 forced universities to close on in March 2020, Prof. Mbogho wanted to find a way to simulate her in-person teaching in the new remote and online learning environment in which she and her students found themselves. She discovered it was possible to record her lectures. She took her existing PowerPoint slides and used drawings and graphics to illustrate her points better. For her programming courses she included a demonstration. She and her colleagues quickly discovered that the university's learning management system didn't have the capacity to store the amount of data that they were generating. Instead, she began to upload her lectures to a YouTube channel. Having a repository of her classes on YouTube also proved useful given the difficulties students found keeping up with 'live' online learning.

Read more: Delivering lectures via YouTube to reach students when campuses closed in Kenya

Creating quick, responsive videos to help students grasp difficult concepts in maths

Mr Paul Kahenya is the Acting Director of the Institute of Open and Distance Learning at **Africa Nazarene University** in Nairobi, Kenya. COVID-19 brought many challenges, particularly in how to ensure that meaningful learning took place. In response, Mr Kahenya began to create a series of videos. In the video he tries to explain the particular concept that the students are finding challenging. These are then followed by live chats with students. Videos are uploaded to the universities learning management system, so they become future reference material, as well as being uploaded to You Tube or shared via WhatsApp.

***Read more:** Creating quick, responsive videos to help students grasp difficult concepts in maths in Kenya*

Creating a YouTube channel to teach research methods and using WhatsApp to deliver a training programme in e-publishing

Dr Lydiah Wambugu is a senior lecturer in the **University of Nairobi**'s School of Open and Distance Learning. Dr Wambugu teaches courses in research methods and in monitoring and evaluation. She has developed her own YouTube channel through which she publishes her lessons. Her lessons are designed to be learner-centred, by addressing problems that students raise directly in the class, or those that have been common in previous classes. She encourages students to ask questions in the comment section and commits to answering these later, either through WhatsApp or email. Dr Wambugu also developed a training programme for academics on e-publishing, designed to be collaborative, and to make use of social media tools to support Kenyan academics to publish online. The training is offered through WhatsApp, and makes uses of videos, 'voice notes', texts and questions to interact with those taking part. Sessions are hosted live, but the content remains in the channel for those who miss the live session.

***Read more:** Creating a YouTube channel to teach research methods in Nairobi, Kenya — and beyond*

Read more: Using WhatsApp to deliver a training programme in e-publishing for academics in Kenya

Mobile labs that enable Kenyan engineering students to run virtual simulations, wherever they are, and creating a personal teaching platform for students

Mr Oteri Omae Malack is a lecturer in the Department of Telecommunication and Information Engineering at **Jomo Kenyatta University of Agriculture and Technology** in Kenya. Mr Omae has used the open-source Arduino platform to develop mobile labs to teach engineering, computer science and technology students. The Arduino platform is combined with Tinkercad, a free, easy-to-use application for 3D design, electronics, and coding. This has enabled students to undertake practical sessions without being present on campus. It has been especially valuable during the COVID-19 period, allowing students to remotely connect and to conduct their programming virtually. Mr Omae has also developed his own online learning platform to teach students taking engineering, computer science and technology courses. The platform is a personal initiative, begun in 2019, which collects together a range of digital resources that he has developed into what he calls a 'one-stop shop'.

Read more: *Mobile labs that enable Kenyan engineering students to run virtual simulations, wherever they are*

Read more: 'Oteri Omae: The Lecturer' — creating a personal teaching platform for engineering students in Kenya

From PowerPoints and PDFs to interactive lessons delivered online

Ms Edith Murugi is an assistant lecturer in the Department of Information Science at **Kenya Methodist University** (KeMU). When the COVID-19 pandemic interrupted teaching, Ms Murugi began to develop new content in response to the learning needs of her students. Initially, she was using PowerPoint slides, and PDF copies of her notes to teach. She has subsequently developed more interactive content, which is hosted via the university's learning management systems, and includes video recordings of her lectures, curated links to other resources to cover more practical aspects of what she is teaching, and a series of activities, which are embedded in her live online sessions and can also be accessed later. She felt that the online classes were still missing something. As a result, she sought to introduce some activities into lessons such as group discussions and debates or asking learners to try something out and then share their experiences.

Read more: *From PowerPoints and PDFs to interactive lessons delivered online in Nairobi, Kenya*

Creating mobile toolkits to teach peace and conflict studies

Mr Timothy Gachanga is a lecturer at the **Institute of Social Transformation at Tangaza University College**, Nairobi, and a part-time Lecturer at Kenyatta University. Mr Gachanga has developed two toolkits, delivered through a mobile phone application (app), to support his teaching in conflict studies. The Conflict Resolution and Transformation Toolkit app aims to provide learners with a basic understanding of the field of conflict resolution and transformation. The Peace and Conflict Reporting Toolkit app is designed to support those who wish to learn about reporting in situations of conflict. By creating an app, rather than hosting his materials on an existing website, students can download and access much of the content offline, wherever they are. The toolkits include digital notes, embedded YouTube videos, and links to access online journals or any other digital content relevant to the course

Read more: *Creating mobile toolkits to teach peace and conflict studies in Kenya*

Randomizing maths problems to meet the learning needs of large classes

Dr Jared Ongaro is a lecturer in pure mathematics in the **University of Nairobi**'s School of Mathematics. Dr Ongaro and his colleagues often teach large classes, which makes it difficult to provide unique mathematical problems for each student to solve. They use the open-source e-learning platform, Moodle, but because the problems are simply shuffled students receive problems that have already been tackled by their peers. Dr Ongaro led a team at the university which worked with the University of Sheffield, UK, to create the SOMAS learning platform. SOMAS is built on Moodle but allows randomisation, so that each student receives a randomly generated problem to solve.

Read more: *Randomizing maths problems to meet the learning needs of large classes in Nairobi, Kenya*

Taking architecture studios online by integrating design software and digital content

Architect Joel Oyuga is a technologist in the School of Architecture and Spatial Planning at the **Technical University of Kenya** (TUK). Following an exchange visit to Germany, Mr Oyuga began to pioneer the use of Moodle within the university. Training in architecture typically requires significant practical work, and studio units, which are spread across the three years of a diploma course, are foundational. Mr Oyuga utilizes an innovative approach in delivering studio work. He combines tools such as Archicad for Education use, and has designed interactive studio content for training in architectural design based on the Moodle platform. During live sessions, he takes learners through the content, while on Moodle he has created a series of activities and created multimedia resources, using text, videos — including documentaries — and graphics. He meets virtually with his students to discuss their projects.

Read more: *Taking architecture studios online by integrating design software and digital content in Kenya*

Creating videos with student role-players to reach learners

Dr Caroline Alenoghena is a lecturer in the Department of Telecommunications Engineering at the **Federal University of Technology, Minna** and also lectures at the Centre for Open, Distance and e-Learning at the university. She has created a series of short videos for her undergraduate students, using cameras for capturing the videos and Adobe 360 for editing and to add sound effects and graphics. In some cases, she has used students to role-play in her videos, and some have become very good at it. She feels that the scenarios she describes in her financial literacy course are more realistic when demonstrated visually through role play in videos. She hosts the videos on the university's learning management system to enable her students to access them.

Read more: *Creating videos with student role-players to reach learners in Minna, Nigeria*

Mastering new tools to create multimedia content for learners

Mrs Mary Adeoye is an e-tutor at the **Ladoke Akintola University of Technology**'s Open and Distance Learning Centre. Mrs Adeoye uses software such as Camtasia to create multimedia content for her students, particularly videos. To create her content, she combines information from different sources, and adapts these to fit the centre's standard templates for audio and visual materials. She prepares slides using PowerPoint and PDF documents and using Camtasia (a screen recording and video editing tool), she demonstrates and explains the lessons to her students. The lessons are edited further with Camtasia to remove any noise and the recording is then uploaded on the centre's learning management system for access by students. Videos are also sent to distance learning students on CD as part of their learning package, while some are made available on YouTube.

Read more: *Mastering new tools to create multimedia content for learners in Ogbomosho, Nigeria*

A digital culture encourages innovation across the university

Dr Folorunsho Taliha is a lecturer in the Department of Mechatronics at the **Federal University of Technology, Minna**. Dr Taliha is concerned to create content that will engage his students and support their learning. To do this he uses a combination of tools, including Camtasia (a video-editing software package), PowerPoint and Canvas (an e-learning platform) to create lessons in general engineering and entrepreneurship. He adds voice-overs to the PowerPoint presentations using Camtasia, and then uploads recordings to the e-learning platform.

Read more: *A digital culture encourages innovation across the university in Minna, Nigeria*

Developing digital spaces that enable students to become co-creators

Professor Peter Aborisade and **Professor Funmi Olubode-Sawe** represent the Blended Learning Research Group at the **Federal University of Technology Akure,** Nigeria. They both teach English for academic purposes with about 4,000 students taking the course each year, supported by 10 instructors. The group uses Moodle, posting existing content that has been designed for online learning and to enable self-paced learning. Some content is created in PowerPoint, some in Word, and in some cases additional materials are gathered from other sites. Students are assigned to work in small groups and given topics which they work on collaboratively, co-creating knowledge on the learning platform's wiki. After this, their term papers are submitted to the platform's blog. The facilitators use wikis, blogs and discussion forums as well as Moodle's quizzes and survey tools in order to support learning and engage students.

Read more: *Developing digital spaces that enable students to become co-creators in Akure, Nigeria*

Making use of the technology at hand to meet learners needs

Professor Temitope Eniola is a Professor of Microbiology at **Joseph Ayo Babalola University** in Osun State, Nigeria. He creates his teaching material in digital formats, using tools that are available to him. He started sharing his lecture notes via Google Drive because of the limitations imposed by the size of attachments that could be sent through email, and in 2017 moved on to Google Classroom.

Read more: *Making use of the technology at hand to meet learners needs in Osun State, Nigeria*

Going beyond PowerPoint teaching by using 'voice notes', social media and creating new digital materials

Dr Jacob Opele is a senior lecturer in the Department of Library and Information Science, **Federal University of Technology Oye-Ekiti**. Dr Opele records his lessons in audio format through 'voice notes' and shares them to groups of his students on WhatsApp and through email groups. He uses free 'voice note' apps, such as Google Keep and Smart Voice Recorder. With these he records his lectures and shares them with students. He also accompanies his 'voice notes' on WhatsApp with slides.

Read more: *Going beyond PowerPoint teaching by using 'voice notes', social media and creating new digital materials in Oye-Ekiti, Nigeria*

Creating digital materials for e-learning students in agriculture

Mrs Olasumbo Oladipupo is an e-tutor for agricultural economics and extension at **Ladoke Akintola University of Technology**'s Open and Distance Learning Centre. She sources information from open educational resources (OERs) and print books to develop content for her undergraduate students in agriculture, following the curriculum provided by the Nigerian Universities Commission. Mrs Olasumbo uses a combination of text, images and smart art to create engaging slides using PowerPoint. She then uses Camtasia (a video-editing software package) to record and edit videos, in which she talks her students through the slides.

Read more: *Creating digital materials for e-learning students in agriculture in Ogbomosho, Nigeria*

Engineering, education and innovation combine to develop new digital learning applications

Professor Musa Aibinu is professor of mechatronics engineering at the **Federal University of Technology Minna** and is also Director of the Centre for Open, Distance and e-Learning (CODeL). Professor Aibinu's research group have developed a number of digital learning applications and tools. SabiMONI is a learner-centred financial literacy training package, available as an app. SMESabi is an e-learning platform and mobile application which was developed to support undergraduate entrepreneurship studies. The Virtual Lab for Clean Energy was developed by a joint effort by researchers from FUT Minna, Ibrahim Babangida University, Ladoke Akintola University of Science and Technology Ogbomoso and First Technical University, Ibadan, and international partners.

Read more: *Engineering, education and innovation combine to develop new digital learning applications in Minna, Nigeria*

Building a bespoke learning system to serve public health students across Africa

Dr Daniel Ekpah is an academic and computer engineer at the **University of Port Harcourt**. He also supports the African Centre of Excellence for Public Health and Toxicological Research. The Centre runs PhD and master's programmes in different health specialities for students across Africa. Dr Ekpah and his colleagues were faced with the challenge of providing a remote learning environment for students who are located in various countries across Africa. He developed a hybrid learning system by combining three free or open-source software applications: Moodle, Cisco Webex and Google Classroom to develop a unique learning environment. Zoom and plagiarism detection software were also integrated into the system, creating a customised tool that made the most of each application's strengths, but which overcame the limitations of each.

Read more: *Building a bespoke learning system in Port Harcourt, Nigeria to serve public health students across Africa*

Tackling topical issues and supporting young people through bibliotherapy — how videos help to communicate with learners

Dr Sola Owolabi is an academic and librarian at **Landmark University**. Dr Owolabi creates videos and multimedia packages to teach his courses and regularly develops videos for social orientation and awareness, for students in his university community and beyond. Dr Owolabi also produces book reviews and runs bibliotherapy sessions within his university. He uses his mobile phone for recording and processes the videos, using software like Vimeo and FreeCam. At the moment, his cast is drawn from interested individuals around him, but he hopes to attract more experienced artists.

Read more: *Tackling topical issues and supporting young people through bibliotherapy — how videos help to communicate with learners in Kwara State, Nigeria*

5 Synthesis of the stories

5.1 What digital learning content has been produced?

27 stories developed through existing networks and a rapid snowballing of contacts

27 stories of innovation were developed, from the original submissions, and these were reviewed to identify common themes. Our methodology, and the limitations we encountered, as described in section 4, within the duration of the project, means this is a limited sample – a snapshot of practices that relied on the examples that could be identified in the literature, from the immediate networks of each researcher, or a modest 'snowballing' as academics made introductions to their colleagues. Despite its limitations it nevertheless tells us something interesting about digital practices in teaching and learning.

Two overall categories emerged. We classify eight out of 27 stories as detailing the creation of original digital learning content. A further 19 do not discuss the creation of original content but do describe the use of existing or new digital tools in innovative ways to present content to learners.

Original learning content creation

	Innovator	***University***	***Subject***	***Content & Tools***	***Benefit***	***Country***
Mobile labs that enable Kenyan engineering students to run virtual simulations	Oteri Omae Malack	Jomo Kenyatta University of Agriculture & Technology	Engineering	Mobile lab (Arduino, Tinkercad)	Practical learning; student access in large cohorts	Kenya
Creating quick, responsive videos to help students grasp difficult concepts in maths	Paul Kahenya	Africa Nazarene University	Maths	Videos (YouTube, WhatsApp)	Deeper understanding of key concepts	Kenya
Randomizing maths problems to meet the learning needs of large classes	Jared Ongaro	University of Nairobi	Maths	Random problem generator (Moodle)	Practical learning; online assessment	Kenya
Creating mobile toolkits to teach peace and conflict studies	Timothy Gachanga	Tangaza University College	Peace and conflict	App development	Offline learning; access	Kenya
Building a digital application to simulate engineering lab practicals	Eric Tutu Tchao		Engineering	Mobile lab	Practical learning; student access in large cohorts	Ghana
Tackling topical issues and supporting young people through bibliotherapy	Sola Owolabi	Landmark University	Social issues, mass communication	Videos (Vimeo, FreeCam, YouTube, Facebook)	Awareness raising	Nigeria
Creating videos with student role-players to reach learners	Caroline Alenoghena	Federal University of Technology, Minna	Financial literacy	Videos (Adobe 360, Google Meet)	Engaging students; local content creation	Nigeria

Engineering, education and innovation combine to develop new digital learning applications	Musa Aibinu	University of Technology Minna	Engineering	App development	Practical learning; student access in large cohorts	Nigeria

Use of tools and platforms to deliver content

	Innovator	***University***	***Subject***	***Tools***	***Benefit***	***Country***
Delivering lectures via YouTube to reach students when campuses closed	Audrey Mbogho	University States Int'l University-Africa	Computer science, programming	YouTube, PowerPoint Zoom	Remote access to lectures	Kenya
Creating a YouTube channel to teach research methods	Lydiah Wambugu	University of Nairobi	Research methods	YouTube	Remote access to lectures	Kenya
Using WhatsApp to deliver a training programme in e-publishing	Lydiah Wambugu	University of Nairobi	Academic publishing	WhatsApp	Self-study	Kenya
From PowerPoints and PDFs to interactive lessons delivered online	Edith Murugi	Kenya Methodist University	Information systems	Moodle, Google Classroom	Remote access to lectures	Kenya
Taking architecture studios online by integrating design software and digital content	Joel Oyuga	Technical University of Kenya	Architecture	Archicad, Moodle	Remote access to studio tools	Kenya
Creating a personal teaching platform for students	Oteri Omae Malack	Jomo Kenyatta University of Agriculture & Technology	Engineering	YouTube, website creation	Remote access to lectures and learning materials	Kenya
Putting lectures online -mastering new tools to reach students as campuses closed	Alex Kwarteng	Kwame Nkrumah University of Science and Technology	Immunology	Zoom	Remote access to lectures	Ghana
Experimenting with digital tools to engage students in their learning	Augustina Sylverken	Kwame Nkrumah University of Science and Technology	Medical microbiology, research methods	Menitmeter, Kahoot, Edmodo	Participation in lectures	Ghana
Interactive content gives art education students control over their own learning	Harry Barton Essel	Kwame Nkrumah University of Science and Technology	Education		Remote self-study	Ghana
'Voice notes', screen recordings and finding the right platforms have helped to keep students learning	Charles Apprey	Kwame Nkrumah University of Science & Technology	Biochemistry	WhatsApp, Snagit, Telegram, KNUST Virtual Class	Remote access to lectures	Ghana
Passion to deliver and realising PowerPoint wasn't enough led to learning videos	Henry Mensah	Kwame Nkrumah University of Science & Technology	Business studies	Screencast-o-Matic, YouTube	Remote access to lectures	Ghana

Using a learning management system to structure, distribute and disseminate learning materials	Eric Opuku	Kwame Nkrumah University of Science & Technology	Telecommunications	Sakai, PowerPoint, storyboard application	Remote access to lectures	Ghana
Mastering new tools to create multimedia content for learners	Mary Adeoye	Ladoke Akintola University of Technology	Business & accounting	Camtasia, PowerPoint, YouTube	Remote access to lectures	Nigeria
A digital culture encourages innovation across the university	Folorunsho Taliha	Federal University of Technology, Minna	Engineering, entrepreneurship, financial literacy	Camtasia, PowerPoint, Canvas	Remote access to lectures	Nigeria
Developing digital spaces that enable students to become co-creators	Peter Aborisade and Funmi Olubode-Sawe	Federal University of Technology Akure	English	Moodle	Self-study, collaborative content creation and learning	Nigeria
Making use of the technology at hand to meet learners needs	Temitope Eniola	Joseph Ayo Babalola University	Microbiology	Google Classroom, Zoom	Remote access to lectures	Nigeria
Going beyond PowerPoint teaching by using 'voice notes', social media and creating new digital materials	Jacob Opele	Federal University of Technology Oye-Ekiti	Information science	WhatsApp, Google Keep, Smart Voice Recorder, Zoom	Remote access to lectures	Nigeria
Creating digital materials for e-learning students in agriculture	Olasumbo Oladipupo	Ladoke Akintola University of Technology	Agricultural economics and extension	Camtasia, PowerPoint	Remote access to lectures	Nigeria
Building a bespoke learning system to serve public health students across Africa	Daniel Ekpah	University of Port Harcourt	ICT	Moodle, Cisco Webex, Google Classroom	Remote access to lectures, access to learning materials, creation of custom learning tool	Nigeria

6 What can we learn about innovation in digital learning?

6.1 Emerging themes

Products, platforms, tools and content

Our original intention was to surface stories of digital content creation. We anticipated that it was in the creation of content that we would find examples of African academics developing their own materials for students, and in doing so this would help to shift the prevailing narrative. As is often the case, our findings have demonstrated a different, although no-less innovative, set of practices.

Boundaries are blurred, but more people are using tools to share content than are creating new content

The boundaries between the creation of new digital content, and the use of digital tools to repurpose existing content or to make it more accessible to users, are blurred and not always easy to define. In some instances, lecturers have used digital tools to augment existing materials – such as providing voice overs to slides (Apprey, Murugi, Opele, Oladipupo) and providing video lecturers or audio files (Mensah). In some cases, they have used authoring tools to create supplement existing materials, adding graphics or embedding shorter videos and recordings (Alenoghena, Adeoye, Essel, Kahenya, Oyuga, Taliha). Our sample nevertheless suggests that there is greater adoption of existing digital tools to present and share learning material or content in new ways than there is the creation of original or new digital learning content.

Repurposing video-conferencing platforms

While the use of Zoom to deliver lectures is perhaps less surprising, given its rapid rise to become a ubiquitous technology for videoconferencing in many sectors over the last 18 months, it is notable that many academics have used it to record their lectures (Kwarteng), and to then edit these and upload them to other platforms for students to watch at a later date (Mbogho, Wambugu). Also notable are the numbers of lecturers who have turned to other recording tools – both audio and video tools – to create short videos to enliven other materials and to make them more engaging to students (Adeoye, Mensah, Murugi, Oladipupo). In several instances such tools have been used to transform standard lecturing slides created in PowerPoint (Mbogho, Murugi). Several of the innovators referred to the use of such tools – whether live or asynchronous video or audio – as a way to bring a greater 'teacher' presence while campuses were closed and classes were dispersed (Eniola, Opele).

A bricolage of tools

In several cases lecturers have brought several tools together in a 'bricolage' to meet the needs they have identified and to create what is often referred to by innovators as 'multimedia content' (Apprey, Ekpah, Oyuga, Sylverken). For some this was because existing or freely available tools did not provide all the functions they needed, and so they were forced to combine tools to achieve their desired result. In other cases, it suggests the creation of entirely new approaches.

Access to existing platforms is key

Most innovators use existing platforms to enable students to access the digital content they have created or are providing access to. These mix specialist e-learning platforms designed for educational use, either in use by their institutions, such as the Moodle (Abinu, Aborisade & Olubode-Sawe, Ekpah, Ongaro, Oyuga, Murugi), or Sakai (Opuku) Learning Management Systems (LMS), or those available as commercial cloud services for any educator to use such as Edmodo (Sylverken) or Canvas (Taliha), and general or commercial platforms for distributing digital content, such as YouTube (Mbogho, Wambugu), WhatsApp (Gachanga, Kahenya, Opele, Wambugu) and Google Playstore (Gachanga).

A drive to make content more widely accessible

While a significant number of universities have developed their own e-learning platforms or learning management systems, several academics spoke of turning to publicly accessible platforms and services such as YouTube (Adeoye, Mbogho, Owolabi, Wambugu), to host their content. In some cases, this was because institutional systems struggled with the file sizes that video recordings created, but a strong motivation seems to have been to make content more widely available, beyond their immediate institutions and teaching groups.

Existing tools can enable existing content to be shared better

Many of the innovators identified significant benefits to learners as a result of new ways of presenting and sharing content using digital tools (Essel, Kwarteng, Mensah, Oteri, Taliha, Tchao, Wambugu). While the creation of entirely new digital content may be innovative and desirable, in the context of improving teaching and learning, there are significant opportunities for existing technologies to be 'deployed' in different ways to improve student access to, engagement with and understanding of learning content.

Open source and 'freemium' tools are important

Without access to funding and without institutional access to software or subscriptions to cloud services, the availability of open-source software (including Moodle) and of 'freemium' tools was a significant enabler for several innovators (Ekpah, Kahenya).

Innovators are self-taught and lack learning design expertise

While a handful of innovators have backgrounds in engineering or information technology or other technical fields (Aibinu, Ekpah, Mbogho, Oteri, Tchao), most spoke of having to teach themselves how to use digital tools and did so with limited access to training or support from experts or dedicated units within their institutions. The lack of institutional support means that 'instructional design' or 'learning design' expertise is often missing. There are opportunities to improve the pedagogy underpinning content creation

Individuals invest their own time and money

In a significant number of cases, innovators are investing their own money and time, and are teaching themselves the necessary skills and developing their proficiency through trial and error. Developing these products is therefore conditional on having the extra resources to purchase subscriptions or other required resources (Alenoghena, Oladipupo). Without institutional backing, significant sections of the faculty could be excluded from participating in these important areas of content development.

Innovation is contextual

Innovation is often created out of an identified need. Innovation needs to be understood as being relative to the environment in which it is introduced, and to the prevailing practices of the individuals involved. In all these cases, the innovators recognised that existing ways of enabling learning for their students were inadequate. Inadequacies stemmed from factors such as very large class sizes (Aborisade & Olubode-Sawe, Opuku, Tchao) or 'traditional' approaches to teaching, which created limited access to materials and learning for the student, limited interaction between students and between students and lecturers, limited engagement of students in their own learning (Aborisade & Olubode-Sawe, Essel), limited exposure of students to greater levels of creativity, and the need for greater practical or hands-on learning experiences (Kwarteng, Oteri, Oyuga, Tchao).

COVID-19 was an impetus for innovation…

The campus closures required by the COVID-19 pandemic are cited by many innovators and have been significant features of their professional and personal lives (Ekpah). As a result of the pandemic, there is now wider acceptance of remote learning and of digital content. Greater exposure to technology-mediated learning is reducing 'technophobia' and encouraging greater 'buy-in' for digital innovations.

… but not all innovation was a pandemic response

While the pandemic was the impetus for innovation in some cases, there were many initiatives and practices underway before these events, which were simply accelerated by the need created, and the greater space that this provided to experiment with new ways of teaching (Aborisade & Olubode-Sawe, Oteri, Oyugo, Ogaro).

Innovation is mainly an individual affair

These innovations often occur without wider institutional support. This may be in terms of funding to develop the content or create the tool, or to subscribe to externally provided tools and services (Gachanga, Opele, Eniola, Opuku, Oteri, Sylverken, Wambugu). It may also be in the lack of enabling institutional policies, to encourage and support such work to be done, or specific training and technical support from professional staff.

Varied institutionalisation and support

These innovations are being incorporated into institutional frameworks in differing degrees. In some universities, the LMS or other platforms provided by the university make incorporation easier and are used by the innovators (Murugi, Opuku). In others where the development of the content is entirely by the innovator, in cooperation within the wider university setting does not necessarily occur (Murugi, Ongaro, Oyuga).

6.2 What drives innovators?

What do these innovators from across the three countries appear to have in common? Through a discussion amongst the research team, we were able to identify some characteristics that are common to many of the innovators.

Innovators have commitment

They are are committed to their craft, willing to 'step out' or go beyond their usual responsibilities and to undertake work that is not always supported by their institutions.

They have strong self-drive

They are motivated, enthusiastic and determined to make a difference to the quality and value of education received by their students.

They are problem-solvers

Their work is 'needs-based' and responds to a clear demand. They are solving a specific problem which they have identified within their own context.

They make the most of opportunities

They draw on existing situations to achieve something new or better. That may be through repurposing content or tools available to them, or treating an unexpected event, such as the COVID-19 pandemic – as an opportunity and additional incentive to try something new.

They are bold and take risks

They do not let barriers such as a lack of support, tools, or infrastructure deter them.

They are agile

They move quickly to respond to an identified need.

They invest

They commit both their own time and money to acquire the skills, knowledge or tools needed to achieve their outcomes and create what is in many cases a public good.

6.3 What enables and prevents the creation of digital content?

Common themes

Our analysis of the stories, as a research team and with external stakeholders, identified a number of common enabling factors, as well as a series of barriers that innovators face.

Theme	Enabling factors	Obstacles and barriers
Infrastructure and facilities	Increasing access to reliable and better speed internet, through broadband or mobile data connections. Availability of cheap, 'freemium' or open-source online resources for digital content creation. Mobility and the ability to do more 'on the move' or remotely through mobile phones and other devices.	Lack of reliable power, reliable and affordable broadband with good bandwidth or reliable and affordable mobile data network, access to digital studios.
Skills, knowledge and training	Training in digital content development. Existing IT skills and digital literacy. Centres of expertise in open and distance learning and multi-campus institutions.	Difficulties in creating or sourcing original or locally created content. Limited IT skills and digital literacy. Lack of time to master new skills or to develop new content.
Financial	A university budget to encourage and support this level of innovation and to expand opportunities.	Inadequate financial support (no budget for incubation of innovative ideas or for access to specific tools and services, data subscriptions). Cost of hardware and subscriptions to software (also due to currency exchange).
Reward systems	Recognition for innovative work and incentives to invest additional effort.	Lack of incentives for academics to innovate or recognition when they do.
Enabling policy	University policies and strategies that embed the use of innovative technology.	Lack of institutional and national policies.
Trust	Creating dialogue about the value of sharing and growing an awareness of its potential benefits.	A reluctance to share information on various best practices both at individual and institutional level.
Security	Concerns over security on campus may encourage more learners to seek remote solutions.	

7 The promise and the potential – a vision for digital teaching and learning

Distilling our findings with senior academics and university managers

We used our stories, and an initial synthesis of the key themes, to facilitate discussions with a selected group of innovators, and subsequently with a wider group of senior academics and university managers from the three countries. Through that process we identified further enablers and barriers to digital content creation and to digital learning more broadly, but perhaps most interestingly we asked participants to reflect on what these stories said to them about the prospects for digital teaching and learning more broadly. After a period where digital learning has been thrust onto many universities and their staff and students, this opportunity to gather, albeit from a relatively small group, a sense of where they want to go in future is instructive.

7.1 A vision for the future

Expanding access and opening up learning on and off campus

Almost universally, our participants feel that using digital tools is essential to meet the demand for higher education in their countries, and the challenge of providing access to growing student populations. While for some the benefits lay in the expansion of distance learning, or in enabling teaching staff to work more effectively across multi-campus institutions, many felt that digital learning could also improve access to learning on-campus under 'normal' conditions – providing new ways to reach learners where classes are large and face to face interaction between teacher and student is limited, or where limited laboratory and other facilities mean that it is difficult for students to get sufficient practical and hands-on experience.

> ***'There is no turning back'***
>
> ***'The challenge of large numbers means digital is the way to go. It's an opportunity to open up higher education'***

Rethinking pedagogy

The focus of our study and our discussions meant that our participants had already expressed an interest in digital learning and an appetite to explore its possibilities. Nevertheless, few identified themselves as experts in digital learning – most related stories of experimentation to solve problems that they encountered. A common theme across all groups was that digital tools and modes of learning provided an impetus to rethink pedagogies, and to consider how they could better meet the needs of their learners, by blending digital and in-classroom teaching and learning and making best use of each space, and to enable them to engage with ideas and knowledge in more flexible ways.

Collaboration between universities

The stories we published show that academics in different places, institutions and disciplines are doing similar things with similar tools, while some are experimenting with quite different approaches. Observing both the commonalities and differences led participants to suggest that greater collaboration between universities was imperative, both to avoid duplication of effort and to learn from each other, so that new ideas and approaches could be replicated elsewhere. Collaborating within and across countries would enable universities to do more with less, and to make improvements to teaching practice more rapidly.

'We should encourage collaboration between institutions in sharing digital content'

'There is a need to work together and not work in silos'

Equipping educators

The fact that many academics had been forced to learn on the job, and had little access to professional expertise, suggested that greater investment was needed in training and support for lecturers. Some of the support suggested was in selecting the best tools and using these effectively, but the importance or learning or instructional design was also noted, and the risk that a focus on the technology – devices, tools, and platforms – could mean that the pedagogical principles that underpin the design and facilitation of good learning could be lost. At the same time, it is important that academics not be dissuaded from innovating by excessive regulation of their practice, since – as the stories show – necessity had driven much innovation in practice, and much of it only loosely enabled by the institutions themselves.

'There needs to be equity in the vision, equity of opportunity to create, making sure that as much as possible we have a level field for people to be innovative.'

Investing in infrastructure

Many of the challenges noted by innovators, and by discussants in the workshop, related to unreliable infrastructure – from internet connectivity to reliable power supply, to more advanced facilities on campus for producing and editing content. Our stories focused on the experiences of academics developing content, but it is likely that the challenges faced by students are much greater, particularly those away from major urban centres, or unable to afford the costs of mobile data to download or stream content. Investing in infrastructure and access– directly on campus, and indirectly by negotiating with telecoms providers – will be vital if the potential of digital learning, in full or blended forms is to be realised. Experiences during the pandemic suggest it is possible, with universities in several countries negotiating with mobile providers to zero-rate data when accessing educational sites online.[26]

'We need to ensure leaders are digitally savvy'

Changing attitudes and demonstrating digital leadership

A common theme was the readiness of academic leaders to make the changes necessary across institutions, from policy to infrastructure. Participants framed this as 'digital leadership'. To get beyond the rhetoric of digital possibility, participants were clear that attitudinal shifts would be needed – from dealing with the constraints to teaching and learning now to imagining, investing and leading institutions into a digitally enabled future. That, they suggested, would need to be supported at many levels of academic management and leadership.

The need for advocacy

Opportunities to document examples of new practices and to tell the stories of academics innovating in teaching and learning were felt to be important and could play an important role in shifting attitudes and raising awareness. In doing so they could help to build the case for greater investment and support for digital infrastructure and support. At the same time, telling these stories and sharing these examples more widely, between academic communities, between institutions and between higher

[26] Dell, 'Zero-Rating Online Learning – Not as Simple as It Sounds'; 'Covid-19: Zero Rated Websites'.

education systems could help to ensure that the benefits of innovations in pedagogy and the development of new content are realised by many more learners.

> ***'Institutionalization means embedding, before you have an embedding you have to have awareness, before you have awareness you have to have to have an understanding'***
>
> ***'Have we grown awareness among policy makers and decision makers? Do they really understand?'***

Reward and promotion

A common obstacle to change in higher education are the prevailing incentive and reward systems. For many academics, progression is through publication, and dedication to teaching does little for promotion prospects. Participants were clear that to really enable the potential of digital learning to be realised, and to encourage and reward individual lecturers to invest precious time in exploring new tools and approaches, it needs to be rewarded and encouraged. Developing pedagogy must score favourably against research outputs for that to be the case. As one participant noted, reward and incentives are not simply about financial compensation, and there are opportunities to recognise good practice – which benefits institutions as well as individual students – in other ways.

> ***'Look at the reward system of universities. It may not be giving money, but everyone wants to climb up, to progress. So, accelerate promotion. Every innovation counts for so many publications'***

Frameworks to support practice

Not all is within the scope of individual institutions, the role of national university commissions and higher education councils was noted as being critical. By setting clear policy directions that encourage academics to be rewarded for innovation in pedagogy, and institutions for setting appropriate policy and providing the necessary support, they can help to shift the system to derive greater benefit from digital technologies. Yet, while national policy frameworks have an important role to play, participants also cautioned against the risk that over-regulation could restrict the freedom of academics to experiment and explore new ways of teaching. The freedom and space to innovate must be preserved if similar stories to those profiled above are to emerge in other contexts.

Learning loops

The development of digital content, and the wider use of digital tools, is still an emerging practice in many institutions. Participants noted that as institutions and academic groups experiment with new approaches and tools, they will need to pay close attention to the needs and experiences of their students, and to adapt practice in response to their feedback, to ensure that the benefits to learning are realised.

> ***'We need to think about how to implement the innovation more widely, so others can benefit.'***

7.2 Conclusions

More evidence of adaptation and use of digital tools to present and share

While we set out to surface stories of digital content creation, our findings have demonstrated a different, although no-less innovative, set of practices. The boundaries between the creation of new digital content, and the use of digital tools to repurpose

learning material than of the creation of new digital content

existing content or to make it more accessible to users, are blurred and not always easy to define. In general terms, there is greater adoption of existing digital tools to present and share learning material or content in new ways than there is the creation of original or new digital content.

The voices of learners are missing, and we need to understand equity better

The voices that we capture here come from academics innovating in their day-to-day practices. This provides valuable insights, particularly in so far as it sheds a light on the work which is done outside of larger projects or university initiatives and often outside of formal funding. However, the voices of students – the learners and users of the tools and content created – are notable in their absence, and further work is needed to understand their experience of these shifts in practice. The stories and data we were able to gather between February and late April 2021 have also not allowed us to say much about differences or similarities in gender – both in terms of the opportunities to innovate, and the extent to which innovations might meet the needs of male and female learners. The stories offer glimmers of issues to do with equity of access – whether that is access by academics to the tools, time and other resources to create content and deliver digital learning, or to the ability of students to gain access to the materials and spaces created for them – but as our workshop discussions emphasised, these questions need much deeper exploration to ensure that the possibilities of digital learning are not embraced without sufficient attention to the considerable barriers that must be overcome for many users to benefit.

Open educational resources could be transformative, but concerns over intellectual property needs to be addressed

Greater awareness of and support to make use of – and to contribute to – open educational resources could be particularly significant. But for the potential of OERs and shared content to be realised, significant wariness over intellectual property needs to be addressed. Misunderstanding and in some cases mistrust may prevent the greatest impact of new practices and content from being realised. The discussions around innovation, copyright, ownership and openness have emphasised the importance of understanding intellectual property concerns, and the opportunities that different licensing models, particularly open licenses, might offer. It is nevertheless important to take academics concerns seriously, both because they may wish to 'protect' their innovation, and because they reflect experiences of the prevailing systems of research publication, which often feel and frequently are exclusionary.

> '***Low resourced institutions and individuals can come up with these ideas, with technology that they have not been brought up on. That we can think of reaching our students in these ways is inspiring'***

Stories can inspire

In parallel to the process of investigating innovative practices, we sought to make the stories of innovation more visible. The power of those stories – of academics innovating in situations of limited resources or without significant institutional support – served to inspire others. Other academics and university managers saw these as examples of what was possible, within contexts like their own.

Change is possible and institutional support could be transformative

While the last 18 months have brought huge pressures on universities, their staff, and their students, it has also show that change is possible. If universities can respond with clear digital strategies, targeted investment, and efforts to clear obstacles and encourage and enable staff, they could realise significant improvements to teaching and learning. Institutional support, and coordination action amongst universities and their leadership through national associations and regional partnerships could significantly enhance existing efforts and help to scale these further.

> ***'COVID has brought pressures to reprioritize and realign, ICT has to continue to be prioritized beyond the pandemic'***

There is a desire and readiness but skills gaps and support hamper change

There is a desire and readiness amongst academics to innovate but limited knowledge about what is possible, limited access to the tools needed, and a lack of institutional support to make time and modest funding available all constrain practice. Faculty are not necessarily knowledgeable about the emerging technologies and the best options available to them to create digital content or leverage technology in their teaching.

Low-cost innovations may be easier to scale

In all cases, innovators had created new content or used digital tools in new ways without significant financial and technical support. While more investment is undoubtedly needed to ensure more lecturers have an opportunity to adapt their pedagogy in similar ways, and so more students can benefit, the ability to innovate at low-cost innovation also provides a foundation for future sustainability.

> ***'Limited funding can be an enabler! Much as it is a limiting factor, it can be an enabler if I can use the same resources to reach many more institutions.'***

Infrastructure and technology are still a significant barrier and lead to significant inequities

The need for academics to invest their own resources limits the opportunity for innovation to those with their own private means – to pay for software subscriptions, broadband or data costs, or to invest in new equipment. This is likely to further limit opportunities for the academic community.

8 Recommendations

For academics

Recommendation 1 Experiment with digital tools and be bold in rethinking pedagogy. Seek opportunities to share and to collaborate as you do.

Recommendation 2 Explore the use of Creative Commons licenses to enable you to protect your authorship but to allow others to use, adapt and build on what you create too, and increase its reach and impact as they do.

Recommendation 3 Seek training and make use of free courses and communities of practice to build your skills.

Recommendation 4 Ensure that learner needs are at the centre, and that good pedagogy is at the heart, so that new content and new ways of learning meet the needs of those learners, and match their access to technology and connectivity.

For university leaders and managers

Recommendation 1 Foster and support digital leadership to create new visions for digitally enabled learning and teaching and to inspire new practices and solutions.

Recommendation 2 Grow awareness of the need for innovation in digital learning and the associated rewards by holding information sharing events for the whole university community – faculty and students

Recommendation 3 Incentivise new approaches to teaching by changing reward and promotion systems so that innovative teaching practice is recognised alongside research outputs.

Recommendation 4 Invest in training, support and digital tools to enable academics to innovate and ensure that there is adequate support to learning or instructional design to improve pedagogy and quality. But do not discourage or obstruct those with a passion and drive to innovate. Ensure that support is available to all.

For national policy makers

Recommendation 1 Foster dialogue to build trust around innovation and to encourage collaboration within and between higher education institutions. Maximise opportunities and incentives to collaborate, to enable innovative practice to be taken to scale and to achieve greater more for learners.

Recommendation 2 Invest in digital infrastructure. Work with telecommunications providers to reduce the cost of mobile data for learning. Address inequities in learning by focus specifically on connecting those who are most excluded.

Recommendation 3 Develop policy and guidelines to support innovation in teaching and learning technologies and invest through budgetary allocations and other initiatives such as incubator programmes.

Recommendation 4 Develop and promote quality assurance standards to guide and support digital learning and digital content creation, to ensure that digital learning is also pedagogically strong.

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9.1 Workshop 1

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9.2 Workshop 2

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Annex 2: Glossary of terms

Apps	Application
CODeL	Centre for Open, Distance and e-Learning
ETDs	Electronic Thesis and Dissertation
FUT	Federal University of Technology Minna
KeMU	Kenya Methodist University
KNUST	Kwame Nkrumah University of Science and Technology
LMS	Learning Management System
MOOC	Massive Open Online Courses
NOUN	National Open University of Nigeria
OATD	Open Access Thesis and Dissertation
OER	Open Educational Resources
TUK	Technical University of Kenya

Annex 3: Summary of literature review

9.3 Regional review

This review shows a diversity of practice relating to digital learning content creation in higher education across the continent. The majority of evidence of these activities comes from grey literature, suggesting that these issues are under explored at the academic publication level. In providing support for their staff, there was evidence of adaption and reuse of existing resources from other institutions, for example, University of Rwanda's Online/Blended Module Quality Review Rubric[27] and University of Namibia's use of a training course for staff from Johns Hopkins University.[28] While some institutions with a longer history of digital learning display a robust strategic/policy response to the issues (for example, Open University of Tanzania, UCT)[29], the response of others seems to relate more to emergency remote teaching during the pandemic (UNAM). There was evidence of internal activities to create and support digital learning content, as well as involvement of external projects and partners in providing digital learning courses at Makerere[30] and Mzumbe University.[31] There was evidence of academics creating open educational resources in Tanzania and South Africa[32] and in African 'small states of the Commonwealth'[33]. Finally, research by Madge et al. suggests that students can be responsible for creating digital learning content.[34]

Approaches from institutional grey literature

UR eLearning Platform. 'University of Rwanda E-Learning Platform: Teacher Guide'. University of Rwanda, 16 September 2020. https://ur.ac.rw/documents/policies/E-LEARNING%20PLATFORM%20TEACHER%20GUIDE.pdf.

This resource for faculty at the University of Rwanda gives guidance on using the university e-learning platform (Moodle) and on best practice for designing online learning. The stated aim of the resource is to act as an introduction to the e-learning platform (p.3) and starts from the basic logging in (pp.3-4) to more advanced course building and enrolment (pp.6-12). Stipulations as to what should be included in the course introduction and within course topics are stated (p.5). Faculty are strongly encouraged to make use of discussion forums on their courses, as well as assignments and quiz. However, there is no mention of synchronous teaching activities, for example, seminars or lectures using video conferencing software. Definitions for some of the components of courses are provided (p.6).

UR eLearning Platform. 'Online/Blended Module Quality Review Rubric'. University of Rwanda, 16 September 2020. https://ur.ac.rw/IMG/pdf/online_blended_module_quality_review_rubric.pdf

This resource is described as a 'module-level quality rubric for reviewing and improving the instructional design and accessibility of online modules' featuring '37 instructional design and accessibility standards' (p.4). The standards provide an indication of instructional design activities such as preparation of storyboards and module development templates (standard 1). The resource promotes the use of Open

[27] UR eLearning Platform, 'Online/Blended Module Quality Review Rubric'.
[28] University of Namibia, 'Teaching Remotely'.
[29] UCT Centre for Innovation in Learning and Teaching, 'UCT Formal Online Education Project'; Open University of Tanzania, 'Information and Communication Technology Policy'.
[30] Gupta et al., 'Lessons Learned from Implementing E-Learning for the Education of Health Professionals in Resource-Constrained Countries'.
[31] Ghasia et al., 'Reflection on E-Learning System of the Mzumbe University in Tanzania: Successes, Challenges and Way Forward'.
[32] Hoosen and Butcher, 'Understanding the Impact of OER: Achievements and Challenges'.
[33] VUSSC, 'The Virtual University for Small States of the Commonwealth (VUSSC)'.
[34] Madge et al., '*WhatsApp* Use among African International Distance Education (IDE) Students'.

Education Resources (standard 22), and text is stipulated as the primary method of conveying information (standard 24). The latter may reflect an institutional acknowledgement of the limited access to internet/data experienced by some students. The rubric is an adapted version of the Open State University of New York course quality review rubric.

University of Rwanda. 'Digital Repository Policy'. University of Rwanda, October 2020. https://ur.ac.rw/documents/policies/UR%20DIGITAL%20REPOSITORY%20POLICY01476520201019094315.pdf.

This policy aims to showcase digital resources created by the University so as to 'provide visibility and influence to (sic) global audiences' (p.3). The policy stipulates that it encompasses research outputs and also other resources including 'teaching and learning materials' (p.3). The motivation for storing teaching and learning materials is expressed in motivations iv and v (p.5), to improve the student experience and foster an information-rich learning environment.

University of Namibia. 'Teaching Remotely'. University of Namibia, 19 March 2020. https://www.unam.edu.na/about-unam/unams-stance-on-coronavirus-covid-19/getting-started.

This is a collection of webpages providing guidance and support for UNAM staff when teaching remotely during the Coronavirus pandemic.

Getting started

Guidance is provided on using Panopto, a lecture recording software, suggesting that lecturers are using recorded lectures as teaching content for remote learning. Staff are also given access to Moodle 101, a short course on using Moodle to 'develop materials for online learning', gain familiarity with 'facilitation strategies and tools' and 'practical guidance on how to create online assessment tasks'.

Best Practice: Online Pedagogies for Staff

Lecturers are given access to a Johns Hopkin's University course on online teaching, which introduces elements of instructional design, quality assessment, content development and facilitation for online learning resources.

CPDTLI Snippet 1: Assessment

Lecturers are offered guidance on preparing assessment suitable for online learning, including self-marking quizzes and reflective assignments and e-portfolios. Links to resources with information on how to set up and design such assessments are provided. Lecturers are offered advice on best practice for designing online tests and exams to prevent cheating, for example, by using time limits for tests, asking reflective and application-style questions and using question randomisation from a large bank of questions to prevent students from collaborating during the test.

UCT Centre for Innovation in Learning and Teaching. 'UCT Formal Online Education Project', 2019. http://www.cilt.uct.ac.za/cilt/ufo-ed.

This University of Cape Town (South Africa) project funds the development of blended and online courses at undergraduate level and fully online courses at postgraduate level. Successful bids are given 'online course design' support as well as 'video and visual materials production' along with marketing, budgetary and facilitation and course management support. Criteria considered when applications are evaluated include the likely demand for the course and the capacity of the academic/teaching team to deliver it. For undergraduate level, courses which can offer improved 'learning and student success' when offered in a blended/online mode are particularly of interest, while for postgraduate courses the potential for the programme to scale and penetrate new markets is an essential factor for funding.

Open University of Tanzania. 'Information and Communication Technology Policy'. Open University of Tanzania, 2019.

This Open University of Tanzania policy covers the academic years 2019/20 – 2023/24. The policy relates to general ICT infrastructure and internet services issues, but also to ICT issues relating to digital learning. Section 2.2.1 stipulates that instructors and students should undergo training on teaching and learning using Moodle, however, areas for improvement remain, with small numbers of courses uploaded and a lack of multimedia and additional resources (p.5). In the associated policy statements in section 2.2.3, the University commits to facilitating transformation from face-to-face and blended learning to fully online learning and building capacity for instructional designers and lecturers in achieving this (p.5). In section 2.3.2. the policy addresses the issue of online assessment and associated problems with plagiarism (p.6). It also stipulates that an ethical code of conduct needs to be developed for instructors in online teaching, suggesting lecturers need supporting rules and guidelines for online interactions with students (p.6).

Approaches from academic literature

Ghasia, Mohamed, Haruni Machumu, Chang Zhu, and Koen DePryck. 'Reflection on E-Learning System of the Mzumbe University in Tanzania: Successes, Challenges and Way Forward', n.d., 13. https://www.researchgate.net/publication/344014943_Reflection_on_e-learning_system_of_the_Mzumbe_University_in_Tanzania_Successes_challenges_and_way_forward.

This case study uses non-participant observations and document analysis to explore Mzumbe University's approach to digital learning, successes, challenges and lessons learned (p.111). Since the adoption of Moodle for online teaching in 2009, lecturers have engaged with the system by uploading lecture slides and providing discussion forums, quizzes and assignments (p.112). However, in the academic year 2015/16, the majority of courses registered on Moodle were not populated with content and activities (pp.112-113). Successful blended learning courses include the Master of Science in Health Monitoring and Evaluation, offered in collaboration with the University of California, San Francisco (p.114). Academic staff have undertaken internal training in teaching online as the e-learning system was rolled out to new campuses as well as training in digital content creation as part of the VLIR-UOS project (p.115). Additionally, several university staff have completed Master's and PhDs in the area of learning technology (p.115). Challenges, including limited ICT infrastructure, a lack of online pedagogy and technical skills among staff and deficiencies in agreed policy and approaches to digital learning, were summarised (p.115). A number of lessons learned, including the need for technical and organisational support for staff to engage with digital learning, the importance of recognising organisational values and culture (for example, when rolling out digital learning across different campuses), avoiding too great a focus on technologies to the expense of other factors, aligning initiatives with organisational needs and overall strategies and policies and further training for lecturers to make the transition to digital learning, were identified (pp.116-118).

Gupta, Manu, Sophie Marsden, Tony Oluka, Reetu Sharma, and Henry Lucas. 'Lessons Learned from Implementing E-Learning for the Education of Health Professionals in Resource-Constrained Countries'. The Electronic Journal of E-Learning 15, no. 2 (2017): 12. https://files.eric.ed.gov/fulltext/EJ1141880.pdf.

This paper examines health education courses taught online in three low- and middle-income countries. Using a case study approach, the authors examine the Indian Institute for Health Management and Research (IIHMR), the Indian Institute of Public Health Gandhinagar (IIPHG) and Makerere University College of Health Sciences, Uganda to draw common themes and issues experienced in the provision of health education facilitated by online learning in low- and middle-income countries (p.145).

Makerere University facilitates digital learning using a Moodle learning management system which is highly subscribed with over 60,000 users and 1500 courses (p.149).

However, the learning management system is often used more as a repository for lecture slides rather than making active use of features such as quizzes, assignments and discussion forums (p.149). Other projects and development partners working with the University provide digital learning courses (p.149). Blended learning courses have been offered in the past, some using video conferencing software to facilitate synchronous teaching (p.150). Challenges experienced by lecturers and students in engaging with digital learning include those relating ICT infrastructure, connectivity and devices but also policy, as University policies are oriented towards traditional teaching, including mandating attendance at face-to-face lectures (p.150).

Madge, Clare, Markus Roos Breines, Mwazvita Tapiwa Beatrice Dalu, Ashley Gunter, Jenna Mittelmeier, Paul Prinsloo, and Parvati Raghuram. 'WhatsApp Use among African International Distance Education (IDE) Students: Transferring, Translating and Transforming Educational Experiences'. Learning, Media and Technology 44, no. 3 (3 July 2019): 267–82. https://doi.org/10.1080/17439884.2019.1628048.

This study uses questionnaires and interviews to explore how students engaged in international distance education (IDE) at University of South Africa (UNISA) use WhatsApp to 'transfer, translate and transform' their educational experience (p.267) and thus participated in creating digital learning content in a communal learning setting. Of the students, the vast majority of whom were South African or from other southern African countries (p.269), 94% used social media to support their learning, with WhatsApp being the most popular platform (p.271). Students used WhatsApp for socialising and networking with peers, but also for informal learning opportunities, as access to WhatsApp was more data-efficient than accessing the university's formal learning platform my.unisa (p.273). The students, who were predominantly studying part-time while in full-time employment, used the groups for discussions on career experiences and work projects, furthering their formal studies (p.274). As the WhatsApp groups grew in size, some students formed their own smaller study groups, sometimes using structured sessions, rules and timetabling, as well as one-to-one mentoring, thus 'blurring the boundaries between the formal and informal learning sphere' (p.275). Inequalities arose for students who were older and less technically confident (p.275) and those who struggled with internet access and affordability (pp.276-277).

Evidence of international organisations

VUSSC. 'The Virtual University for Small States of the Commonwealth (VUSSC)'. Accessed 12 May 2021. https://vussc.col.org/.

The Virtual University for Small States of the Commonwealth (VUSSC) is a network of small commonwealth states. The states included in Africa are Botswana, The Gambia, Eswatini, Lesotho, Mauritius, Namibia and Seychelles as well as 26 other states from Asia, the Pacific, the Caribbean and Mediterranean. The purpose of the network is to collaboratively develop Open Educational Resources (OER) and to offer approval for courses developed by institutions in member countries under the Transnational Qualifications Framework (TQF). The TQF was designed to allow for the easy comparison of qualifications between member states, facilitating sharing of educational resources. Nine programmes have so far been TQF-approved, eight of them in Africa at the University of Seychelles, University of Mauritius and Botswana Open University. TQF certification allows for greater international recognition of qualifications and allows students to work and transfer credits abroad more easily.

Commonwealth of Learning. 2021. *Partnering with Institutions – VUSSC connects with courses*. [Online]. Available from: https://vussc.col.org/wp-content/uploads/2020/06/VUSSC-web-content-June-2020-courses-programs-developed.pdf

This document describes how some institutions have partnered with Commonwealth of Learning to offer VUSSC courses at Certificate, Bachelors and Postgraduate Diploma level, as well as smaller online courses and MOOCs. The African

institutions included are Botswana Open University, University of Eswatini, National University of Lesotho, Mauritius University of Training and Development, Mauritius Qualifications Authority, Open University of Mauritius, University of Mauritius, Namibian College of Open Learning, Seychelles Institute of Management, Seychelles Tourism Academy and University of Seychelles.

Hoosen, Sarah, and Neil Butcher. 'Understanding the Impact of OER: Achievements and Challenges'. UNESCO Institute for Information Technologies in Education & OER Africa. Accessed 2 February 2021. https://www.oerafrica.org/system/files/13390/understandingtheimpactofoer2019-1.pdf?file=1&type=node&id=13390&force=1.

This report from provides a global overview of OER understanding, policy commitments, adoption, financing and sustainability, diversity and inclusion and research on educational impact and effectiveness. The report ends with a number of country case studies, including South Africa and Tanzania, which will be summarised here.

South Africa (pp.147-160): The report states that there been 'modest uptake' of OER in South Africa (p.147). Most notably the University of Cape Town (UCT) has launched a number of massive open online courses (MOOCs), the University of Pretoria has created an OER portal, and the University of the Western Cape (UWC) has released some materials as OER. UCT has a number of OER policies in place, while University of South Africa (UNISA), UWC and University of Witwatersrand have implemented OER strategies. A number of universities have created their own OER repositories.

Tanzania: (pp.161-164): Most of the work in Tanzania on OER has been conducted by the Open University of Tanzania (OUT). From 2016, most OUT courses were offered in an online format and released under a Creative Commons Attribution (CC-BY) licence. The OUT OER policy includes a review process by external academics in order to ensure quality. Additionally, at Mkwawa University College of Education (MUCE), staff developed OER for integration into teaching training programmes.

9.4 Country level review

Issues related to academic practice

Adaptation is required where existing methods of teaching and learning are no longer 'fit for purpose'

The literature suggests that a strong incentive on the part of some academics to create digital content is the fact that existing modes of teaching and learning are increasingly unviable. **Oteri (2020)** argues that most technical courses in engineering, science and technology have always been taught using very expensive equipment stationed in a static lab setup on campus grounds, which compel student to 'go to the lab'. This level of inflexibility is further compounded when the student numbers are high. Oteri has developed a mobile lab as a simple, inexpensive, portable kit to enable greater flexibility for the student by 'bringing' this practical component to the student.

Oteri, Omae Malack. 'The Application of IoT Layer One Based Mobile Labs in Engineering, Science and Technology Education'. In 2020 IEEE Bombay Section Signature Conference (IBSSC), 192–97, 2020. https://doi.org/10.1109/IBSSC51096.2020.9332177.

Adanu, et al (2010), in response to an ongoing loss of new medical graduates to Ghana's health care system through 'brain drain', reviewed the quality of e-resources available to their large classes of medical students in the University of Ghana. Their aim was to analyse the use of electronic materials by students and to ascertain the perception of students in that regard. They defined e-learning to involve the conversion of selected aspects of scientific or clinical training to a multimedia format that can be viewed on any recent generation of laptop or desktop computer. The researchers developed two digital materials (covering polymerase chain reaction and total

abdominal hysterectomy) which were distributed to selected medical students from the University of Ghana Medical School (UGMS) and the School of Medical Sciences (SMS), Kwame Nkrumah University of Science and Technology (KNUST). The programmes consist of interactive text, lectures, photographs, videos, or animations, all of which have been designed, executed, and produced by Ghanaian faculty members. After the distribution and perusal of digital course contents for two weeks, respondents were presented with self-administered questionnaires with results indicating that respondents noted that the e-learning programmes were 'more effective' in comparison to other methods of learning.

Adanu, RMK, Y Adu-Sarkodie, O Opare-Sem, K Nkyekyer, P Donkor, A Lawson, and N C Engleberg. 'Electronic Learning and Open Educational Resources in the Health Sciences in Ghana'. Ghana Medical Journal 44, no. 4 (December 2010): 159–62. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3052833/.

Instructional design processes are essential to quality content creation

Abubakar et al. (2021) developed and validated the e-content package designed to teach automobile lighting system in technical colleges in Niger State, Nigeria. Using a 5 step R & D Model which included: Determination of the contents of e-content teaching and learning package to be developed; Determination of the important e-content skills, knowledge and attitude needed by students in automobile lighting system; Development of a draft e-content teaching and learning package based on the findings from Phase II; Validation of e-content and Revision of the draft e-content teaching and learning package based on feedback from Phase IV. The e-content package was developed on HTML5. The package underwent validation based on an established requirement specification. Also, Alpha and Beta tests were conducted. Three evaluators validated the e-content package in respect to elements like animations, functionality, graphical interface, language, navigation, packaging, typography, emphasis on key concepts, simplicity and its suitability for instruction. The validation was conducted by experts in automobile technology, educational technologists and ICT experts to ensure the clarity, appropriateness, utility, objective, originality and adequacy of content for use in teaching and learning of the subject. The validation confirmed the effectiveness of the package as it was found to perform all the tasks listed in the requirement specification. Their observations were used to modify the package to create a package that will deliver appropriate e-content through a usable learning tool. The study emphasises the value of careful evaluation of both content and platform, while developing teaching and learning packages. Also reflected is the efficacy and possibility of developing packages locally.

Abubakar, A.K., A. Mustapha, and A.E. Raji. 'Development and Validation of E-Content in Teaching and Learning of Automobile Lighting System in Technical Colleges in Niger State, Nigeria'. 2nd International Conference on Information and Communication Technology and its Application (ICTA), 2018. Federal University of Technology, Minna, Niger September 5-6, Accessed 10 May 2021. http://www.imanagerpublications.com.

Abstract concepts require simple, innovative and easily digestible presentations of learning material to ensure that learning outcomes are achieved

Talib et al. (2018) found that acid-base chemistry was one of the many topics in science that was fraught with misconceptions and difficulty, which is capable of affecting the comprehension of the subject by students. The findings of the study also confirm that the method of delivering instruction and the nature of course material affected student assimilation. Based on these findings, the researchers developed an interactive courseware that would facilitate instructional delivery and resolve grey areas in learning. Also, the researchers adopted the Needham Five phases of teaching strategy (instructional design) to complement the courseware. The package was tested by teachers in Universiti Teknologi Malaysia and the Sokoto State University of Nigeria and found to be an effective tool in providing conciseness and clarity in teaching and learning of acid-base chemistry. Teachers are therefore encouraged to design interactive software to support the teaching of difficult subjects.

Talib, Corrienna Abdul, Hassan Aliyu, Adi Maimum Abdul Malik, Kang Hooi Siang, and Marlina Ali. 'Interactive Courseware as an Effective Strategy to Overcome Misconceptions in Acid-Base Chemistry'. In *2018 IEEE 10th International Conference on Engineering Education (ICEED)*, 240–45, 2018. https://doi.org/10.1109/ICEED.2018.8626941.

Using available tools to redesign & present learning content

Abdulrauf and Sulyman (2017) designed an interactive and inclusive software to enhance the teaching and learning of molecular biology for distance learning students. The researchers developed a prototype based on a proposed Conceptual Design Model Courseware for Inclusive Education System (C4IES) which incorporates a definite set of design principles. The consideration was that multimodality and 3-D would improve the learning interface of the courseware and reduce the abstractness of learning. Adobe Photoshop CS6 was used to develop the package while the content learning was developed as a PDF document with links to reference books. Usability, accessibility and motivation based on instructional design elements such as navigational buttons, colour contrast, sound effects, good object magnification, text auditory and multimedia presentation (animation) were systematically factored in. Ninety per cent of the individuals (subject matter experts) who tested it found it to have high usability and suitable for both impaired and able students in regular or distance learning settings. The study supports the need to design learning packages that are inclusive multimodal, as well as ensuring that instructional design principles are introduced to drive both content and tool. The prototype was also created with available resources- the Adobe PhotoshopCS6. C4IES is recommended for learning content software development.

Abdulrauf, Tosho, and Shakirat Haroon Sulyman. 'Enhance Inclusive Learning System: An Instructional Interface of Courseware for Molecular Biology'. *Ilorin Journal of Computer Science and Information Technology* 2, no. 1 (2017): 46–57. https://iljcsit.com.ng/index.php/ILJCSIT/article/view/18.

The use of a digital tool in delivering content can be as effective as traditional modes of conveying concepts.

Ahmed (2020) explored the potential of Instagram for teaching biology. A biology Learning Content Courseware, Instagram Biology Test, Instagram Biology Marking Guide, and Daily Lesson Plan were used as instruments to test the effectiveness of teaching with Instagram. The quasi-experimental research design used 75 undergraduate students of biology of the University of Ilorin as subjects for the study. The study involved an experimental and control group. The control group was taught biology topics using the conventional strategy, while the Instagram instruments were used to teach communicate and test the experimental group. The findings of the study confirm that there was no significant difference between experimental and control group [F (10,25) = 2.129, p>.05]. The study concluded that the use of Instagram in the learning process must be considered based on the study case of the subject treated. The study indicates the need to manage Instagram by targeting specific learning goals. 'The medium is the message' Marshall McLuhan (1964).

Ahmed, Mulkah Adebisi. 'The Efficacy of Instagram on Biology Undergraduate Students in University of Ilorin, Nigeria'. *JPBI (Jurnal Pendidikan Biologi Indonesia)* 6, no. 2 (21 July 2020): 335–40. https://doi.org/10.22219/jpbi.v6i2.12155.

Institutional and national policy issues

Digital learning content is not widespread in its availability, institutional awareness or support

Nyerere (2016), in a baseline survey report that was commissioned by the Commonwealth of Learning (COL) to gather current information on the status of Open and Distance Learning (ODL) established that few universities had any form of digital content. The study respondents were deans or directors of ODL centres/units in 12 universities implementing ODL programmes in Kenya. The report provides a brief context of Kenya's ODL development in terms of national and institutional policies in ODL, access and success in higher education. It provides an analysis of issues related to standards of ODL programmes and their recognition focused on national and institutional quality assurance policies for ODL programmes, modes of delivery, and perceptions of quality and credibility of ODL in the country. Other areas this baseline survey focused on are the adoption and use of Open Educational Resources (OERs) and Massive Open Online Courses (MOOCs). The adoption of OERs and use of MOOCs are both cost-effective means and have the potential to serve mass enrolments with minimal resources. Thus, these should be appealing to the country because of both the scarcity of resources and increasing demand for university education. Specifically, on the State of Digital Content development in Kenya, the survey cited efforts at the University of Nairobi and Kenyatta University. The survey indicated that both the University of Nairobi, through its extramural centres, (now Learning Centres) and Kenyatta University SOVL provided a wide range of programmes using blended learning mode, combining digital instruction with tutorials in various centres across the country. Furthermore, Kenyatta University posts the reading materials to open learning students in the form of module booklets and in portable devices such as CDs. The university also uses e-Blackboard Learning Management System (BLMS) and the Moodle Course Learning Management System to deliver its ODL programmes. The survey further indicates that universities implementing ODL programmes in Kenya have invested in training of some staff in areas such as course module development, but this has not been adequate. Most participants in the survey still cited it as a challenge, indicating that they would like training in skills such as design of interactive modules and online delivery techniques. The survey identified poor teaching/learning practices are also a problem, with lecturers applying traditional modes of delivery (such as the use of lecture notes and handouts) that are not learner-centre.

Nyerere, Jackline. 'Open and Distance Learning in Kenya: A Baseline Survey Report Commissioned by the Commonwealth of Learning'. Report. Commonwealth of Learning (COL), July 2016. http://oasis.col.org/handle/11599/2491.

Developing institutional digital content and ICT policies are prerequisites for enabling digital content development

The review by **Mwaniki, Njihia, Chege and Ireri (2016)** found that policies had been enacted both on at an institutional and national level in Kenya and Ghana. The digital school of virtual and open learning (DSVOL) at Kenyatta University undertook a collaborative initiative which identified best practice for interactive content development and has helped shape the institution's policy on digital learning. Mwaniki, et al. issued tablets with the necessary content to all its registered students. Despite the use of tablets, the instructional material and pedagogical approaches did not change. Almost all the modules uploaded on the university's Moodle platform and in the tablets for the DSVOL programme were and still are soft copies of the print modules with very little interactivity as would be expected in effective online learning. in addition to lack of interactive modules, other factors such as lack of technical support and learner characteristics may affect e-learning outcomes. The authors contend that the ability to develop and use interactive modules will make learning more learner-friendly, flexible and more engaging as learners interact and collaborate in their search for knowledge.

Other lessons learnt from this collaborative initiative, are that: (i)Technology is constantly evolving. There is need therefore for continuous retooling for best practices in online learning. If online facilitators are trained, encouraged, and motivated, they can design and use interactive online learning resources effectively for the benefit of learners. Competence in ICT enhances confidence, motivation and zeal to develop and use online learning materials effectively. (ii) This knowledge can be cascaded to

others to ensure that effective interactive online resources are created and reviewed regularly for relevance. (iii) Management involvement and support should be at the heart of online learning for it to succeed. (iv) It takes time, effort and commitment to create effective interactive modules. (v) Teamwork approach helps because there is need to maintain the momentum and keep learning from each other. (vi) Online facilitators must be assisted to have good ICT skills to help them communicate at a distance using technology. In sum, the results of this initiative were encouraging, the experience gained positively impacted on the facilitators' ability to effectively integrate ICT in online teaching and learning.

Mwaniki, Elizabeth W., Mukirae S. Njihia, Fatuma N. Chege, and Anthony M. Ireri. 'Development of Interactive Online Learning Modules: Lessons from Kenyatta University, Kenya'. Working Paper. Commonwealth of Learning (COL) and Open University Malaysia (OUM), November 2016. http://oasis.col.org/handle/11599/2526.

The **Ministry of Education, Ghana** has developed a three-pillar ICT policy, two of which directly underpin the development of ICT to support teaching and learning in education. The first identified pillar of the policy document is ICT as learning and operating tool. This focuses on the integration and use of software applications and hardware devices as tools to augment the educational environments within the country. This is targeted at enhancing the ICT literacy of educational leaders and administrators, teachers and students in order for them to be able to utilise these tools to get their work done. The policy acknowledges that should ICT be properly managed and channelled, it could serve as a platform that initiates, shapes, and fosters the change of management philosophies and practices that would allow real transformation within and around schools for two primary purposes – to ensure that ICT is used effectively in teaching and learning and also to ensure that school learner outputs are realised in the form of excellence in academic results. The document thus, indicated that the policy direction of the Ministry is certainly aimed at ensuring that all stakeholders within the educational environment are adequately prepared in the area of literacy terms of ICT so as to impact their output. The second identifies pillar in the policy document is ICT as integrated into the Teaching and Learning of Subjects. This talks about the initiative of incorporating ICT into a national educational curriculum that creates the opportunity for policy administrators and teachers to be able to utilise ICT and technological tools in developing teaching and learning materials that covers all subject areas and as well all areas of national life. The policy direction of the Ministry was thus ensuring that teacher from their developmental stages of training through their in-service capacity building are efficiently prepared to develop suitable and correct skills that further provides them with the flexibility to adjust to changing situations of best practices locally and internationally. The policy direction from the perspective of learners gave commitment of creating an enabling environment that enhances students' appreciation and adaption of the use of ICT in teaching of contents of the curricula. In terms of content development, the policy document emphasised their commitment to strengthen the research unit for the compilation and evaluation of digital content for teaching and learning at all levels of the educational system in the country

Ministry of Education. 'ICT in Education Policy'. Ministry of Education, Republic of Ghana, August 2015.

In **Edumadze and Owusu (2013)** we also find an example of policy being developed at the institutional level to support the creation of digital content and ICT applications in faculties and departments for effective and efficient teaching, learning and research. With a focus on the University of Cape Coast (UCC), the study analysed the policy document of UCC relative to the incorporation and use of ICT in teaching and learning in the university. The study noticed that UCC has prioritised its focus on ICT in its quest to optimize efficiency in quality delivery of education thus, setting up an ICT centre with aim of harnessing the benefits of ICT to serve as a catalyst for effective teaching/learning, research, and the promotion of innovation in education thereby aiding it (UCC) to become a Centre of Excellence in Africa.In an attempt to examine the use of ICT in the process of teaching and learning, and to build a more detailed account of measures to equip teachers/lecturers to integrate effectively ICT so as to

achieve institutional objectives of ICT integration in education, the study employed a conceptual framework with an ICT integration planning that incorporates an activity systems focusing on ICT teacher development landscape. The framework was developed in a way that outlines six related areas comprising of: mandate which focuses on the institutional and organizational mandates related to ICT in education and teacher development; actors which addresses the issue of who were involved in the project and the policy objectives which dealt with ICT integration in education and teacher development; resources required to ensure success of the project such as ICT and non - ICT resources available or required for ICT in education have been critically looked at; and regulatory frameworks dealing with curriculum and development frameworks for ICT integration and the community which concentrates on the public private partnership, networks for ICT in education and teacher development were analysed. The findings suggest that on the part of students, ICTRCs are helping them to improve their ICT skills and knowledge even though the relationship between the variables was found not statistically significant. Based on these findings, it was suggested, among other things, that the computer centre of the university of Cape Coast be adequately resourced to develop instructional materials and provide computer-based tutorials for lecturers and students to equip them effectively to be able to integrate ICT into their teaching.

Edumadze, John, and Anthony Kwame Owusu. 'Use of Information and Communication Technology for Teaching and Learning in Ghanaian Universities: Case of University of Cape Coast', 2013. https://ir.ucc.edu.gh/jspui/bitstream/123456789/4188/1/Use%20of%20Information%20and%20Communication%20Technology%20for%20Teaching%20and%20Learning.pdf.

Processes that facilitate or limit the use and growth of digital content

Incentivisation of individual academics is a major factor in supporting digital content creation

Oladele and Modebelu (2017) studied the perception of lecturers at the Distance Learning Institute University of Lagos, of challenges they face in the development of software. One hundred responses were received with 43% females and 57% males. Sixty-nine per cent had PhD as highest qualification and 39% had MSc as the highest qualification. The findings of the study show that the most significant challenges indicated by the respondents were that time limitation affected the quality of the course content (mean: 3.82), most of the external writers lack technical expertise leading to poorly developed content (mean: 3.86) and lecturers are not well incentivised leading to low motivation and low output (mean: 3.57). Of less significance as challenges were the paucity of subject matter experts as writers and lack of motivation to engage in the course development as it does not contribute to career development. The study indicates that the quality of the content is however guaranteed by engaging in evaluation of content (mean: 3.82) and training of academic staff on (3.57). There were significant differences in the perception of the lecturers based on gender and years of experience. Low bandwidth was a major problem for course developers in the institute. The study indicates that time factors, technical expertise and incentivisation are important in encouraging content development by academics.

Oladele, E. O., and O. J. Modebelu. 'Lecturers' Perception of the Challenges of Development of Courseware for Open Distance Learning in Nigeria: A Case of Distance Learning Institute (DLI) University of Lagos.', 2017. https://ir.unilag.edu.ng/handle/123456789/5714.

Organisational factors can be as important as technological availability to digital content creation

Eze et al (2020) used the Technology-Organisation-Environment Framework to investigate factors that affect the adoption of learning technologies in a private higher education institution and found that they clustered more around technology usability, accessibility and service delivery (100%) and organizational factors such as training and support (93%). Environmental factors (attitude of users) mattered (less 53%). Impact related factors which include the skills and experience of the users also ranked high (93%).

Eze, Sunday C., Vera C. A. Chinedu-Eze, Clinton K. Okike, and Adenike O. Bello. 'Factors Influencing the Use of E-Learning Facilities by Students in a Private Higher

Education Institution (HEI) in a Developing Economy'. Humanities and Social Sciences Communications 7, no. 1 (27 October 2020): 1–15. https://doi.org/10.1057/s41599-020-00624-6.

On the use of National Open University of Nigeria MOOCs, **Marshall (2016)** recognizes challenges such as the effect of poor internet access and connectivity, the ivory tower mentality, poor connectivity, unfriendly government policies and poor access to computers. Technology is a major barrier to creation, use and adoption of digital content in Nigeria, but organisational factors are equally significant. Support provided by the institution and government policies will create an enabling environment for successful uptake of content creation and development.

Marshall, Jane. 'MOOCs Have a Massive Potential Market in Africa'. University World News, 1 July 2016. https://www.universityworldnews.com/post.php?story=20160630195218201.

Agbu (2018) explains how the OER, and MOOC project of the National Open University of Nigeria (NOUN) began. The OER was a response to the 2012 UNESCO/Commonwealth of Learning Paris Declaration on Open educational resources. Since the content of NOUN MOOC was funded by the government, the institution has made it open and accessible as an open educational resource. The OER was released with a Creative Commons-Attribution-Share Alike licence and launched in December 2015. A unit was established in 2017 to oversee the process of transforming the courses into a fully open OER through training, awareness seminars, providing technical support, and capacity on how to localize and domesticate the content (creation, assembly, use and reuse the content). Because of the proactiveness of the Institution's management, NOUN was the first West African university to join the OERu, a consortium of 30 post-secondary institutions. To ensure quality, NOUN worked with instructional designers, technical support staff and library staff to develop the content, alongside UNESCO who supported the project by collaborating on the development of a logical framework to support the digital conversion of the content. It is currently available on the NOUN portal NOUN Courseware. The major benefit attributed to the project is the acceptance and cooperation of the faculty who have developed more confidence as users and creators of courseware. However, some challenges accompanied the project such as faculty's mistrust with sharing their content and uncertainty about copyright management and open licensing. Also, many members of the faculty were unsure of how to manage the attribution of reused content. The poor quality of some of the content and the need to evaluate them was a major problem. Despite all odds, NOUN continues to collaborate with institutions within Africa and beyond to support the development of OERs and foster the ideals of openness. Agbu, Mulder, de Vries, Tenebe and Caine (2016) describe NOUN, complemented by an expansive and well developed OER as 'the best of two worlds'. NOUN has worked with international organizations such as UNESCO, European Union and Hewlett Foundation to develop a sustainable OER culture locally, regionally and globally.

Agbu, Jane-frances Obiageli, Fred Mulder, Fred de Vries, Vincent Tenebe, and Abel Caine. 'The Best of Two Open Worlds at the National Open University of Nigeria'. Open Praxis 8, no. 2 (13 May 2016): 111–21. https://doi.org/10.5944/openpraxis.8.2.279.

Agbu, Jane. 'OER and MOOCs at the National Open University of Nigeria | Teachonline.Ca'. Online Learning News, 16 January 2018. https://teachonline.ca/tools-trends/oer-and-moocs-national-open-university-nigeria.