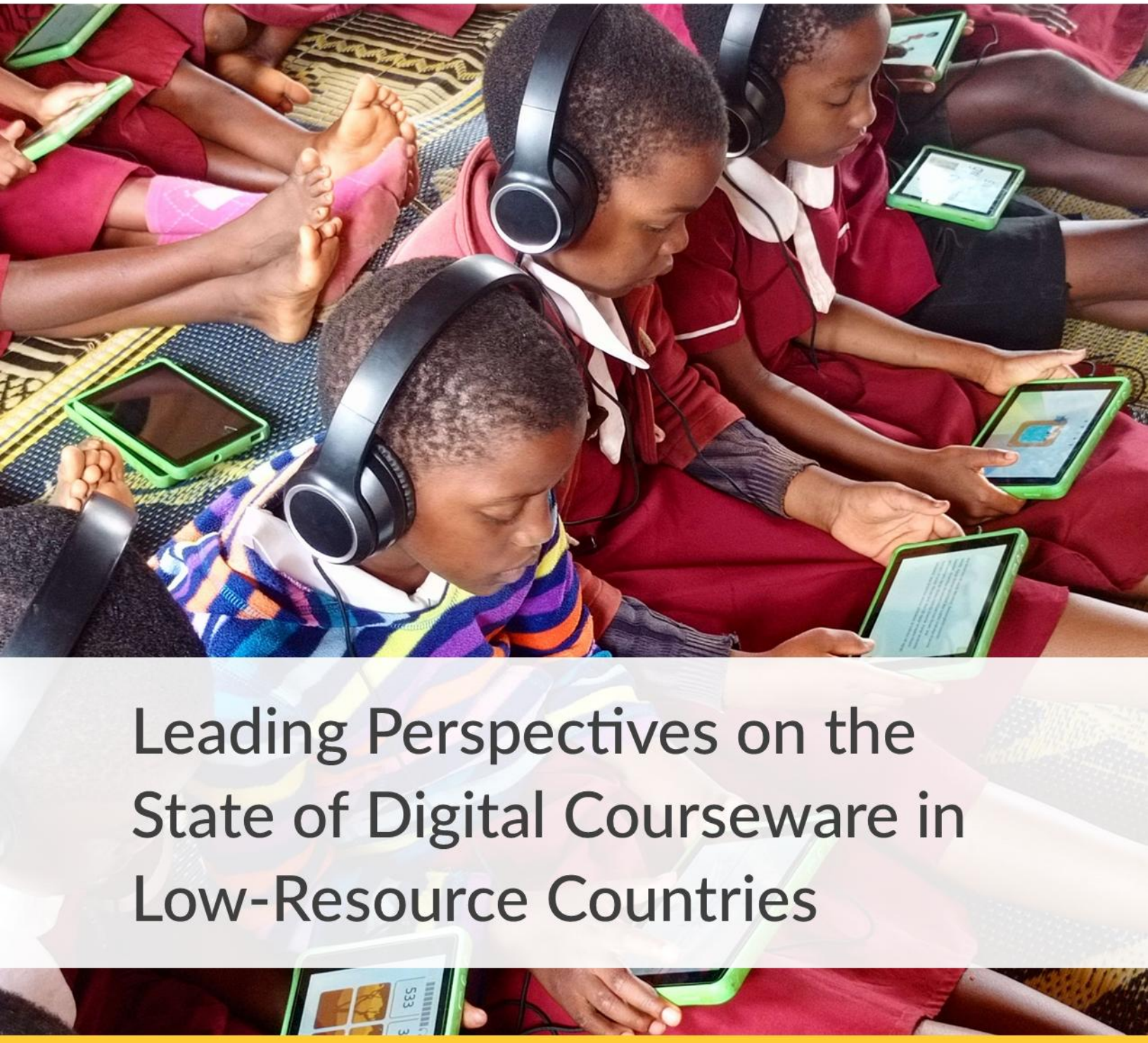
mEducation Alliance

The Spix Foundation



Leading Perspectives on the State of Digital Courseware in Low-Resource Countries

May 2025

The mEducation Alliance is a 501(c)(3) non-profit organization focused on strengthening the education ecosystem to bring wondrous learning. We are particularly focused on the evidence-driven and sustainable role of technology in education to advance quality educational outcomes. Initially formed in 2010, the mEducation Alliance is the largest multi-stakeholder convening platform for government and donor policymakers, other investors, researchers, and practitioners to work together, particularly in lower-resource, developing country contexts. Visit us at https://meducationalliance.org/.

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Abbreviations and Acronyms

ADB	Asian Development Bank
AI	artificial intelligence
BEFIT	Building Education Foundations through Innovation and Technology
CBC	competency-based curriculum
CEMASTEA	Centre for Mathematics, Science and Technology Education in Africa
CEO	chief executive officer
COP	community of practice
COVID-19	coronavirus disease 2019
CREDD	Curriculum Research Development and Assessment Directorate
DLP	Digital Literacy Program
edtech	education technology
GES	Ghana Education Service
ICT	information and communication technology
IDC	interactive digital content
IDRC	International Development Research Centre
KICD	Kenya Institute of Curriculum Development
KII	key informant interview
LAN	local area network
LMS	learning management system
mEA	mEducation Alliance
MoE	Ministry of Education
MOOC	massive open online course
NGO	non-governmental organization
NI3C	Kenya National ICT Innovation and Integration Center
OECD	Organisation for Economic Co-operation and Development
OER	open educational resource
PPP	public-private partnership
REB	Rwanda Education Board
STEM	science, technology, engineering, and mathematics
TIE	Tanzania Institute of Education
TPD	teacher professional development
TSC	Kenya Teachers Service Commission
TVET	technical and vocational education and training
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	U.S. Agency for International Development
$	United States dollar(s)

Acknowledgements

This report is informed by extensive discussions with key representatives from leading implementing organizations, major donors, and national ministries, offering valuable insights into their perspectives and experiences Many informants expressed gratitude for the opportunity to contribute, emphasizing the importance of their sharing their perspectives with each other and the field. Their thoughts, comments, and recommendations are indispensable because they often serve as the frontline funders, advocates, and implementers, driving the advancement of digital education. Their commitment and field experience are critical for the success of these initiatives.

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The authors extend our heartfelt gratitude to the Spix Foundation for supporting this report and to all the informants who generously shared their time, experiences, and valuable insights. Their contributions underscore the significant progress being made in improving education globally, highlighting the critical role digital courseware plays in bridging gaps and fostering learning opportunities. Their dedication and expertise are driving meaningful change, offering hope for a more inclusive and equitable future in education.

At the same time, the interviews revealed that much work remains to be done to ensure digital education reaches every learner, especially in low-resource settings. The mEducation Alliance is privileged to work with the Spix Foundation to stand alongside these committed individuals and organizations and to add our own contributions to this important work.

Executive Summary

mEducation Alliance (mEA) and the ***Spix Foundation*** are working together to support impactful and cost-effective digital learning solutions in lower-resource environments. As a result of their partnership and shared interest in digital learning solutions, the Spix Foundation commissioned mEA to capture the perspectives of key sector players. mEA and the Spix Foundation reaffirm their commitment to supporting industry stakeholders to achieve their shared goals, fostering meaningful progress in digital education.

Between September and November 2024, mEA staff and consultants conducted key informant interviews (KIIs) with 41 ministry officials, global experts, donors, and implementers, alongside focus groups of representatives from ministries in eight countries. mEA interviewed two distinct groups: ***representatives from government entities*** across the African continent and ***members of the mEA network***, comprising donors and implementers actively working in various African countries and beyond.

Key implementation concerns for both groups included issues like the choice between open- and closed-source platforms, ensuring system interoperability, and addressing the balance between offline and online access to digital resources, while appreciating technology development and considering closing the technology divide.

As with the research questions, mEA framed participant perspectives around four themes. Below is a summary of ***findings under each theme***.

Status: ***Digital courseware use in low-resource countries is improving.***

- Digital courseware use in low-resource countries is growing in terms of use, access, and quality, propelled by strategic initiatives and innovations, many of which were accelerated by the response to COVID-19 pandemic.
- Stakeholders, including many of those leading initiatives within country ministries, recognize digital courseware as crucial for education reform, emphasizing the value of collaborative efforts and targeted investments.
- By addressing specific local needs and leveraging partnerships, key programs have demonstrated that digital courseware can thrive even in low-resource environments, including when paired with solar and offline solutions to overcome connectivity issues.
- Content in local languages and aligned with cultural and educational needs is expanding.
- Governments, NGOs, and the private sector are often working together to scale such efforts.
- Training and equipping educators is seen as critical to the sustainability of digital learning initiatives.

Opportunities: ***Participants envision digital courseware as a transformative tool for creating a responsive, engaging, and equitable education system that prepares learners for a rapidly changing world.***

- Informants articulated a vision that emphasizes a synergy between digital tools and traditional teacher-led education, prioritizing inclusivity, quality, and scalability to ensure learning opportunities for all.
- Adaptive courseware is emerging as a means to tailor content to individual learners' needs, pace, and progress, ensuring that each student receives targeted support and enrichment.
- Digital platforms are showing how immediate feedback allows educators to identify gaps and adjust teaching methods promptly.
- Offline-first solutions are demonstrating how inclusion can be addressed even where connectivity is limited
- Low-cost devices and open educational resources (OERs) are beginning to reduce financial barriers to accessing high-quality education.

Challenges: ***Achieving ideal digital learning utilization and access in low-resource areas faces multifaceted challenges across infrastructure, content development, inclusivity, financial sustainability, and teacher training/skilling.***

- While issues of connectivity and power infrastructure are vital, KIIs recognized and focused discussions on areas directly within education.
- While progress in developing sophisticated functions is ongoing, digital learning platforms often lack interoperability, making it difficult to integrate different systems, tools, and devices.
- More open-source platforms are needed to control or even eliminate expensive licensing fees, making them more accessible for low-resource countries and underfunded institutions.
- Open-source software would enable educators and developers to modify and tailor courseware to align with specific curriculum standards, languages, and teaching styles.

Policy considerations: ***The implementation of digital courseware faces various policy challenges.***

- There is a need for improved policies that support digital courseware scaling.
- Specific policies are necessary to ensure alignment with curriculum standards, support teacher training, and comply with regulations.
- The absence of global standards for digital learning platforms is impeding scalability and compatibility across regions.
- Research participants are looking for best practices and guidance on specific policies.

Introduction

This report offers valuable insights and actionable information from key informants to support, scale, and sustain digital courseware initiatives aimed at improving basic literacy, numeracy, and broader learning outcomes in low-resource settings. These insights reflect the collective efforts of leading organizations and country ministries dedicated to advancing this critical work. ***mEducation Alliance (mEA) and the Spix Foundation reaffirm their commitment to supporting these stakeholders to achieve their shared goals, fostering meaningful progress in digital education.***

Background

Over the past two decades, global initiatives have expanded access to education, particularly at the basic education level. However, literacy and numeracy rates remain alarmingly low in low-resource countries and are barriers to higher education and employment opportunities.

A 2022 joint report by the World Bank; United Nations Educational, Scientific and Cultural Organization (UNESCO); UNICEF; U.K. Foreign, Commonwealth, and Development Office (FCDO); U.S. Agency for International Development (USAID); and the Bill & Melinda Gates Foundation found that 70% of children globally are unable to read and comprehend simple text by the age of 10 years old.[1] In Sub-Saharan Africa, this is even more concerning with 90% of children not being able to read by age 10 and of the 98% of young people who enroll at the primary level in Sub-Saharan Africa, only 9% make it to tertiary education and only 6% graduate.[2] Moreover, many children are not attending school globally. Estimated reports are as high as 250 million. Sub-Saharan Africa accounts for close to 30% of this figure, with 1 of 5 African children not attending school.[3]

In contrast, the Programme for International Student Assessment (PISA) 2022 found that 74% of students in Organisation for Economic Co-operation and Development (OECD) countries scored at Level 2 or higher in reading literacy.[4] This means that they could identify the main idea of a moderate length text, find information based on

[1] https://www.worldbank.org/en/news/video/2022/09/23/the-state-of-global-learning-poverty-2022-update

[2] https://www.issuelab.org/resources/35972/35972.pdf

[3] This perspective aligns with the Organisation for Economic Co-operation and Development (OECD)'s *Digital Education Outlook 2023* (https://www.oecd.org/en/publications/2023/12/oecd-digital-education-outlook-2023_c827b81a.html?utm_source=chatgpt.com), which also notes increasing interest and potential of digital courseware within its 38 mostly middle- and high-income countries, but also highlights substantial challenges that need to be addressed to facilitate effective and equitable adoption.

[4] https://gpseducation.oecd.org/IndicatorExplorer?plotter=h5&query=2

explicit criteria, and reflect on the text's purpose.[5] Low-resource countries are at a significant disadvantage.

Digital courseware has emerged as a promising intervention to enhance accessibility, adaptability, and scalability of quality education, especially in underserved regions. A number of random control trials through initiatives such as onebillion, Chimple, and EI/Mindspark are demonstrating measurable results and value for investments. Nonetheless, significant barriers, such as infrastructure gaps, teacher capacity gaps, lack of cultural relevance, and sustainable investments, must be addressed to realize its potential.

mEducation Alliance-Spix Foundation Partnership

mEA and Spix Foundation are working together to support impactful and cost-effective digital learning solutions in lower-resource environments. First founded within USAID in 2010, then established as an independent non-profit in 2020, ***mEducation Alliance (mEA)*** is dedicated to strengthening formal and non-formal educational systems through its network, consisting of the largest education technology (edtech) multi-stakeholder platform connecting government and donor policy-makers, investors, researchers, and practitioners. The ***Spix Foundation***, founded in 2023, focuses on empowering individuals through informal, offline, and self-directed learning. This partnership engages stakeholders to identify impactful strategies for digital courseware deployment in low-resource countries.

Research Approach

As a result of their partnership and shared interest in digital learning solutions, Spix Foundation commissioned mEA to capture the perspectives of key sector players.

Participants

Between September and November 2024, mEA staff and consultants conducted key informant interviews (KIIs) with 41 ministry officials, global experts, donors, and implementers (see list of organizations on the next page), alongside focus groups of representatives from ministries in eight countries (see map below), to gather insights and consolidate important considerations about digital courseware use, particularly in low-resource environments.

[5] https://www.oecd.org/en/topics/sub-issues/reading-literacy.html

African Union Development Agency-NEPAD (AUDA-NEPAD)

Africa
https://www.nepad.org/

Asian Development Bank (ADB)

The Philippines/Asia regional
https://www.adb.org/

Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA)

Kenya
https://www.cemastea.ac.ke/

Christian Blind Mission (CBM) International

USA and Germany/Global
https://www.cbm.org/

Curriculum Research Evaluation Development Directorate (CREDD)

The Gambia
http://www.edugambia.gm/credd

Education Above All Foundation

Qatar/Global
https://www.educationaboveall.org/

Edraak

Jordan/Arab countries
https://www.edraak.org/en/

EIDU

Germany/Kenya
https://eidu.com/

eKitabu

Kenya/Kenya, Rwanda, and Malawi
https://www.ekitabu.com/

Elimutab

Kenya/Africa
https://elimutab.co.ke/

Hempel Foundation

Denmark/Sub-Saharan Africa and South Asia
https://hempelfoundation.com/

iHub

Kenya/Africa
https://ihub.co.ke/

Ghana Education Services (GES)

Ghana
https://ges.gov.gh/

Imagine Worldwide

Malawi/Africa
https://www.imagineworldwide.org/

International Development Research Centre (IDRC)

Canada/Global
https://www.idrc-crdi.ca/en

JBJ Foundation

Malawi
https://www.jbj.foundation/

Kenya Institute of Curriculum Development (KICD)

Kenya
https://kicd.ac.ke/

Kenya Institute of Special Education (KISE)

Kenya
https://www.kise.ac.ke/

Mastercard Foundation

Global/Kenya
https://mastercardfdn.org/en/

Ministry of Basic and Secondary Education (MoBSE)

The Gambia
https://mobse.gov.gm/

Ministry of Education (MoE)

Ghana
https://moe.gov.gh/

Ministry of Education (MOE)

Kenya
https://education.go.ke/

Ministry of Education (MoE)

Liberia
http://www.moeliberia.com/

Ministry of Education (MoEST)

Malawi
https://www.education.gov.mw/

ProFuturo

Spain
https://profuturo.education/en/

ProjeKt Inspire

Tanzania
https://projektinspire.co.tz/

Rwanda Basic Education Board (REB)

Rwanda
https://www.reb.gov.rw/home

Tanzania Institute of Education (TIE)

Tanzania
https://www.tie.go.tz/

The Digital School

United Arab Emirates/Global
https://thedigitalschool.org/

The Teachers Service Commission (TSC)

Kenya
https://teachersonline.tsc.go.ke/

UNESCO

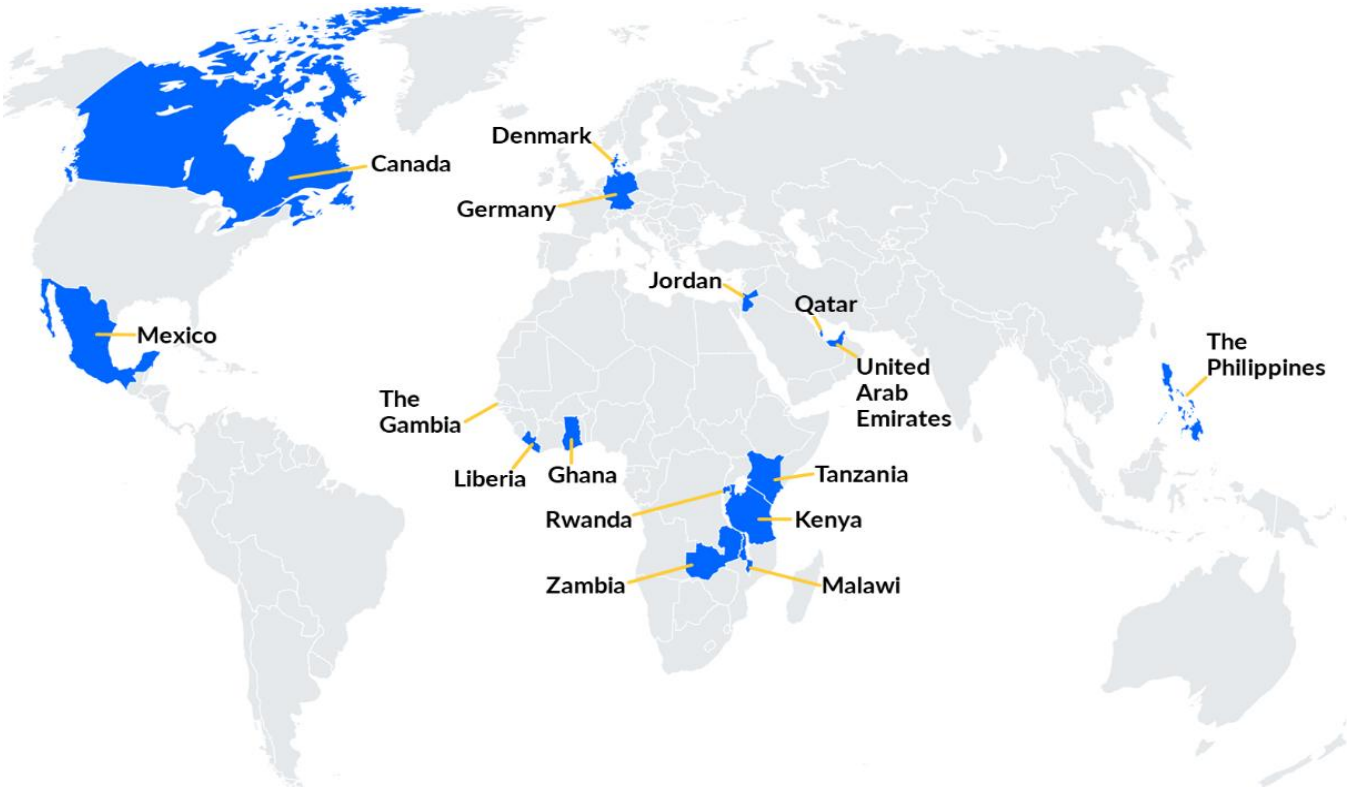
France/Kenya
https://www.unesco.org/en/countries/ke

UpTyke Consulting Ltd.

Kenya
https://uptykeconsulting.co.ke/

VVOB | education for development

Global
https://www.vvob.org/en



The interviews were recorded, documented, and analyzed for common themes and examples. One-page summaries of each of the KIIs and a summary of the Kenyan workshop can be accessed by contacting mEA.

Essentially, mEA interviewed two distinct groups: representatives from government entities across the African continent and members of the mEA network, comprising donors and implementers actively working in various African countries and beyond. The ***government representatives*** provided detailed insights into national policies, drawing from their direct involvement and expertise in shaping and implementing these frameworks. Meanwhile, the ***mEA members*** shared perspectives grounded in practical implementation and innovation, often supported by external funding.

While mEA interviewed both groups about ***relevant policies,*** government representatives demonstrated a deeper understanding of policy intricacies and their alignment with national priorities. In contrast, representatives from donor and implementing organizations emphasized ***operational considerations and challenges*** of specific digital courseware initiatives, which may not be specifically referenced in national policy documents. Directly underwriting digital courseware initiatives provides donors, their Ministry of Education (MoE) counterparts, and implementing organizations some measure of flexibility and greater latitude for experimentation. ***Key implementation concerns*** for both groups included issues like the choice between open- and closed-source platforms, ensuring system interoperability, and addressing

the balance between offline and online access to digital resources, while appreciating technology development and considering closing the technology divide.

Definition of "Digital Courseware" Used

For the purpose of the interviews and related discussions, a broad definition was used for "digital courseware", referring to online or software-based educational materials designed and delivered in an electronic format, including apps, to facilitate learning. These go along with associated platforms and learning management systems (LMSs), as well as the hardware/devices, connectivity, and skilling in edtech pedagogies.

The table below[6] provides examples of various digital courseware.

Digital Courseware

Online or software-based educational materials designed and delivered in an electronic format, including apps, to facilitate learning

Type	Description
E-textbooks	Digital versions of traditional textbooks, often enriched with interactive features like multimedia content, quizzes, and hyperlinks to additional resources
Online courses	Structured learning programs delivered via the internet, ranging from short modules to comprehensive degree programs and often including video lectures, assignments, and assessments
Learning management systems (LMSs)	Software platforms that manage and deliver educational content and that provide tools for creating, distributing, and tracking online courses, as well as facilitating communication between instructors and students
Interactive simulations and virtual labs	Digital environments that allow students to engage in hands-on learning experiences, simulating real-world scenarios and experiments and providing practical experience without the need for physical resources
Educational games	Gamified learning experiences that make education engaging and interactive, often incorporate elements of competition, rewards, and progress tracking to motivate learners
Adaptive learning platforms	Systems that use algorithms and data analytics to personalize the learning experience for each student, adjusting the content and pace based on the learner's performance and needs
Multimedia resources	Audio, video, and interactive content that enhances the learning experience, including recorded lectures, podcasts, animations, and interactive diagrams

[6] Source: https://www.pearson.com/en-us/subject-catalog/p/teaching-and-learning-with-technology/P200000001406/9780137498185

Research Questions

The table below provides a list of the guiding questions for the KIIs.

Category	Questions
Status of digital courseware in the country	• What digital courseware do you have in your country for basic education? • What is the funding model for provision of digital courseware? • Do you have any technical requirements for courseware? • How do you measure the impact and/or success of the digital courseware?
Vision of ideal digital courseware	• What is your ideal vision of how digital courseware should be in your country/jurisdiction? • What is your ideal vision of how this digital courseware should be supported? • How does that vision differ from the current courseware situation? • What are the benefits of your ideal system, and that would make it more ideal? • How would you measure the impact and/or success of this ideal digital courseware deployment?
Challenges/barriers to implementing the ideal digital courseware	• What are the barriers to implementing that idea vision discussed?
Policies and legislation	• Do you have an official edtech policy? • Are there other relevant legislation/policies that would affect courseware development and usage (e.g., data protection laws)? • Who else would you recommend we consult concerning the above?

Themes and Findings

The sections that follow present key findings from the KIIs. As with the research questions, mEA framed participant perspectives around four themes related to digital courseware: the current *status* of use, *opportunities*, *challenges*, and *policy considerations*. Below is a summary of findings under each theme.

Status

Digital courseware use in low-resource countries is improving.

KIIs noted that digital courseware use in low-resource countries is growing in terms of use, access, and quality, propelled by strategic initiatives and innovations, many of which were accelerated by the response to COVID-19 pandemic. Stakeholders, including many of those leading initiatives within country ministries, recognize digital courseware as crucial for education reform, emphasizing the value of collaborative efforts and targeted investments. By addressing specific local needs and leveraging partnerships, key programs have demonstrated that digital courseware can thrive even in low-resource environments, including when paired with solar and offline solutions

to overcome connectivity issues. Content in local languages and aligned with cultural and educational needs is expanding. Governments, NGOs, and the private sector are often working together to scale such efforts. Training and equipping educators is seen as critical to the sustainability of digital learning initiatives.

Opportunities

Participants envision digital courseware as a transformative tool for creating a responsive, engaging, and equitable education system that prepares learners for a rapidly changing world.

Informants articulated a vision which emphasizes a synergy between digital tools and traditional teacher-led education, prioritizing inclusivity, quality, and scalability to ensure learning opportunities for all. Adaptive courseware is emerging as a means to tailor content to individual learners' needs, pace, and progress, ensuring that each student receives targeted support and enrichment. Digital platforms are showing how immediate feedback allows educators to identify gaps and adjust teaching methods promptly. Offline-first solutions, a design and development approach where software applications are built to function seamlessly without requiring a continuous internet connection, are demonstrating how inclusion can be addressed even where connectivity is limited. Finally, low-cost devices and open educational resources (OERs) are beginning to reduce financial barriers to accessing high-quality education.

Challenges

Achieving ideal digital learning utilization and access in low-resource areas faces multifaceted challenges across infrastructure, content development, inclusivity, financial sustainability, and teacher training/skilling.

While issues of connectivity and power infrastructure were discussed as vital, KIIs recognized and focused discussions on areas directly within education. KIIs pointed out that digital learning platforms, while developing sophisticated functions, often lack interoperability, making it difficult to integrate different systems, tools, and devices. Participants stressed the need for more open-source platforms to control or even eliminate expensive licensing fees, making them more accessible for low-resource countries and underfunded institutions. Additionally, open-source software would also enable educators and developers to modify and tailor courseware to align with specific curriculum standards, languages, and teaching styles.

Policy considerations

The implementation of digital courseware faces various policy challenges.

Many informants highlighted the need for improved policies that support digital courseware scaling. Participants thought that specific policies were necessary to ensure alignment with curriculum standards, support teacher training, and comply with regulations. Some ministry informants also suggested that the absence of global standards for digital learning platforms is impeding scalability and compatibility across regions. KIIs are looking for best practices and guidance on specific policies.

Status of Digital Courseware

The informants were asked to provide a status overview of the current state of digital courseware in the basic education sector based on their vantage point of overseeing and/or implementing digital courseware global or national initiatives.

The African policy-makers reported that while their respective countries are making strides in digital learning, the progress remains uneven across various education levels and regions.

Those interviewed commonly indicated that the state of digital courseware in low-resource countries has been steadily increasing and demonstrating measurable impact. Most described digital courseware initiatives which were strategically aligned with the national curriculum and technologically innovative. Representatives from several ministries of education described how their institutions scrambled to launch digital courseware during the COVID-19 pandemic crisis as they aimed to provide some continuity of learning during school closings. They used available ***e-learning platforms***, such as massive open online courses (MOOCs), virtual classrooms, and digital textbooks. At the time, these resources were adapted to serve educational purposes. Some of these platforms remain in place in addition to newer resources designed specifically for education.

Since the pandemic, most informants noted a positive shift in adoption and financing by countries and investments by donors in the expansion of evidence-based and evidence producing edtech initiatives. As a result, many respondents indicated that digital learning materials are being promoted and integrated into basic education delivery, with the goal of improving access to quality education.

Despite the challenges, all informants agreed that digital courseware is now recognized as a critical component of education reform. As an example of a collaborative effort and targeted investment, ***Malawi's Building Education Foundations through Innovation and Technology (BEFIT)***[7] pilot program is primarily funded by a $15.2 million multiplier grant provided by the Global Partnership for Education. Dr. Chomora Mikeka, Malawi Director of Science, Technology, and Math, explained that the program is deploying educational courseware across all primary schools in that country and is one of the several promising examples for scaling and advancing equitable access to digital education.

Informants identified four areas that have influenced the current status of digital courseware:

- Expansion of digital learning
- Flexible learning and delivery models
- Enhanced teacher support
- Emerging assessment tools and data generation

[7] https://www.globalpartnership.org/node/document/download?file=document/file/2024-07-program-document-for-malawi.pdf

Expansion of Digital Learning

The global implementers and ministry representatives interviewed agreed that there has been an expansion of digital learning. While much of this growth was spurred by the COVID-19 pandemic, many organizations and governments alike reported they have been building upon this momentum.

For example, Ms. Nina Bolte, Head of Learning at EIDU, spoke about its expansion initiatives and promising results. Founded in 2015, ***EIDU*** has become a leading education technology platform that is expanding digital access to low-resource countries. EIDU primarily runs in ***Kenya*** where it is reaching hundreds of thousands of pre-primary students through partnerships with local governments. This platform leverages structured pedagogy, interactive learning games, and real-time assessments to enhance foundational skills in literacy and numeracy for young learners. EIDU works closely with government partners to provide digital lesson plans and tools for teachers, as well as customized, engaging content for students on shared smartphones.

Ms. Bolte and her colleagues reported that ***EIDU*** has demonstrated significant improvements in student learning outcomes, with up to 70% of learners reaching proficiency standards in literacy and numeracy, compared to 11.2% in schools without EIDU interventions. These results stem from randomized controlled trials and other evaluations of their scalable learning platform in low-income contexts, notably in Kenya.[8] EIDU aims to reach more than 2 million learners, many in private schools where connectivity and digital literacy is at appreciated levels (in the context of 16 million learners in primary and secondary schools), in Kenya by 2025 and to eventually expand across other regions.

"Online education platforms in Ghana have seen significant growth, with over 673,000 students enrolled in digital courses in 2023, up from 232,000 in 2020."

- Mr. Emmanuel Ocquaye, National STEM Coordinator, Ghana Education Service (GES)

Ghana is actively leveraging digital courseware to transform its education system and enhance learning opportunities across the country. The country has two main digital platforms:

- ***Learning Management Platform (LMP)***, a collaboration with ***Zambia***. LMP provides teachers with pre-recorded lessons and teaching materials. It covers mathematics and English in grades 7-9, and there are plans to expand to grades 10-12 by 2027. The LMP incorporates elements from both ***Ghana*** and ***Zambia***'s curricula, ensuring content fits both systems despite minor differences in terminologies and specific contexts.
- ***Professional Learning Center (PLC)***,[9] a platform for teachers to discuss and improve teaching methods. The content aligns with ***Ghana***'s national curriculum, ensuring it meets set standards.

[8] https://eidu.com/impact

[9] https://ghascd.org/about/

In ***Kenya***, the state of digital learning is rapidly evolving. In 2016, the ***Digital Literacy Program (DLP)***[10] was launched in all public primary schools (more than 23,000) through a multimodal approach. The government is leveraging digital radio, television, and ***interactive digital content (IDC)*** covering all learning areas/subjects in primary and secondary level as well as pre-service and in-service teacher training. Mr. Francis Karanja, the Head of the National ICT Innovation and Integration Center (NI3C) in the MoE, shared that in 2018, the Kenya Institute of Curriculum Development (KICD) developed standards for IDC and employs these standards for digital courseware evaluation, However, the standards are overdue for review to include emerging technologies, such as artificial intelligence (AI) and learner analytics. KICD also developed frameworks for inclusion of digital literacy in competency-based curriculum (CBC) from early years education to senior school. In 2017, KICD developed standards for IDC[11] for material used in pre-primary through grade 12.

The Gambia is driving their digital courseware expansion through two main initiatives: the Online Gambia Project and the Progressive Science and Mathematics Initiative.[12] The ***Online Gambia Project*** started during the COVID-19 pandemic and provides digital content stored on SD cards for use offline in schools and at home. The ***Progressive Science and Mathematics Initiative*** operates in 24 schools offering digital content delivery through smartboards and computers. Both programs are primarily funded by development partners, such as World Bank and Global Partners in Education.

Tanzania is integrating ***information and communication technology (ICT)*** into its education system across all levels, from pre-primary to secondary. Mr. Jonathan Paskali, Chief Curriculum Development Officer at ***Tanzania Institute of Education (TIE)***, described how digital educational games are used for younger learners, while software tools for science and technology at higher levels equip learners with modern, practical skills for advanced education and future careers. Although access is not yet extensive, there is an insistence for more integration of ICT in all aspects of teaching and learning. Much of the expansion efforts in Tanzania has been the result of partnerships between the government and development partners, such as World Bank, UNICEF, and Korean International Cooperation Agency.

[10] https://ict.go.ke/digital-literacy-programmedlp

[11] https://kicd.ac.ke/wp-content/uploads/2017/10/StandardsForCurationofOnlineSupplementaryCurriculumSupportMaterials.pdf

[12] https://documents.worldbank.org/en/publication/documents-reports/documentdetail/981551477028270066/improving-education-performance-in-math-and-science-in-the-gambia-an-overview-of-the-progressive-science-initiative-and-progressive-math-initiative-psi-pmi-and-its-implementation-in-the-gambia

Flexible Learning and Delivery Models

The majority of the informants in this study underscored ***the importance of digital tools for interactive learning and student-centered learning experiences***, particularly to address teacher shortages and overcrowded classrooms, both of which often limit individualized instruction. Further, some informants shared how they are leveraging flexible delivery approaches that can reach a greater number of students and support interactive learning in literacy and numeracy.

Digital courseware can use flexible learning that fosters "independent learners".

Imagine Worldwide, for example, is focused on "child-directed, tech-enabled learning"[13] by providing students with tablets preloaded with adaptive educational software that adjusts to each learner's pace and skill level. Mr. Joe Wolf, Co-Founder and Co-Chief Executive Officer (CEO) of Imagine, noted that this flexible approach is enabling children to learn autonomously, whether in school, at home, or in community centers. Several interviewees agreed on the importance of using flexible learning to foster "independent learners".

According to Dr. Mikeka (Malawi), ***BEFIT*** is advancing courseware access in Malawi using a ***five-window matrix to cover a range of courseware products***: on air, online, offline digital technologies, low-end mobile technologies, and print. Examples include:

- Using television and interactive radio instruction as part of national educational broadcasting services
- Using low-cost central processing units (CPUs; e.g., Raspberry Pi[14]) loaded with OERs
- Pairing open-source learning management systems (e.g., Moodle) with devices that can create local area networks (LANs) without needing to access the internet (e.g., RACHEL[15] servers and Beekee solar-powered units[16] used in Arizona State University's SunSpot initiative[17] higher education programs)

Dr. Mikeka also noted the use of ***thin client computers***, such as those supported by ***nComputing software***,[18] to extend access to digital courseware in resource constrained classrooms.

Also in ***Malawi***, BEFIT and the Ministry are working with ***Imagine Worldwide***, the ***JBJ Foundation***, and others to significantly expand student access to digital courseware with flexible pathways and interactive learning experiences. Mr. Jani Moliis, Strategy Manager at the Foundation, describes the use of solar-powered tablets to deliver content from the ***onebillion.org***'s app, which includes literacy and numeracy lessons. The project also supplements lessons through cartoon-based educational video

[13] https://www.imagineworldwide.org/our-work/child-directed-learning/?utm_source=chatgpt.com

[14] https://www.raspberrypi.com/

[15] https://rachel.worldpossible.org/

[16] https://beekee.ch/

[17] https://news.asu.edu/20230306-global-engagement-sunspot-model-provides-education-access-areas-unreliable-internet

[18] https://www.ncomputing.com/

content from ***Ubongo***,[19] an African-based content developer, in local languages, which are displayed in classrooms to further engage students with interactive learning experiences. This approach helps overcome the challenge of limited digital access, allowing entire classrooms to benefit from educational content designed to boost literacy and numeracy in young students.

Two noteworthy digital courseware initiatives are in ***Kenya***.

- The ***SchoolNet Project***[20] aims to use flexible delivery by connecting all public primary and secondary schools to the internet through the national electricity grid. This three-year project is using optic fiber to connect the schools to national optical fiber backbone infrastructure using existing electricity poles. Funded using the Universal Services Fund (USF), there is no recurrent fee on data usage on part of the schools. This ensures sustainability of the initiative.
- The ***Alice Ngunzu Digital Labs***[21] are being developed through curation and creation of simulations and experiments that will be provided to learners and teachers at no license fee. The project will cover junior school and senior school in Kenya and is planned to be implemented for online and offline access. This is a private sector initiative in parallel to Kenya MoE initiative on digital labs for the same levels of education under the ***Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA)***. Ms. Jacinta Akatsa, Director/CEO of CEMASTEA, explained that the digital labs are curriculum support solution provided by government and will be accessible to all learners in public and private schools, as well as teachers.

Enhanced Teacher Support

Many informants discussed the use of digital courseware for teacher support and capability building, especially in environments where resources and ***teacher professional development (TPD)*** opportunities are limited. In this case, digital courseware addresses a significant need for capacity building.

Ms. Mila Tonarelli, Director of ***ProFuturo***, highlighted the importance of providing educators with the skills and tools necessary to integrate digital content into classrooms. ***Teach For All***[22] and the ***ProFuturo Foundation*** joined forces to implement the Digital Skills and Community Leadership for Teachers and Students project from 2023 to 2024. This initiative, carried out in five countries across three continents, focused on training more than 8,500 teachers through a cascade training approach,[23]

[19] https://www.ubongo.org/

[20] https://icta.go.ke/news?node=41&type=news

[21] https://newsroom.mastercard.com/news/eemea/en/newsroom/press-releases/en/2024/may/mastercard-empowers-digital-inclusion-of-youth-in-kenya-with-launch-of-alice-ngunzu-digital-labs/

[22] https://teachforall.org/

[23] https://profuturo.education/en/observatory/innovative-solutions/building-the-future-of-education-in-africa-cascading-teacher-training/

combining digital skills, collective leadership, and the integration of innovative methodologies. Ms. Tonarelli shared that the quality of the training was very well received by participants by being very practical and connecting to the problems the teachers faced on a daily basis.

David Lazaro, ***Edraak***'s Director, explained that its efforts support teacher development by demonstrating how its K-12 curriculum aligns with national educational standards. ***EIDU*** uses its platform to provide comprehensive resources for teachers, including detailed lesson plans, supplementary guides, and ongoing training that ensures that educators are well equipped to deliver engaging lessons that align with CBC that is applied in most countries in Africa.

> *"The Hempel Foundation supports the Sierra Leone Education Innovation Challenge, a teacher professional development program that includes digital coaching apps for ongoing support, alongside traditional in-person training sessions. This hybrid model is helping cater to the diverse needs of educators while ensuring that they receive practical, on-the-ground support."*
>
> – Ms. Anna Molgaard Thaysen, Hempel Foundation Manager of Education Partnerships

The ***Hempel Foundation*** has prioritized balancing digital and in-person teacher development to address various educational challenges in regions with significant barriers to quality education. For instance, Ms. Anna Molgaard Thaysen, Manager of Education Partnerships, pointed out the Foundation's support of the ***Sierra Leone Education Innovation Challenge***,[24] a TPD program that includes digital coaching apps for ongoing support, alongside traditional in-person training sessions. This hybrid model is helping to cater to the diverse needs of educators, while ensuring that they receive practical, on-the-ground support.

A number of digital courseware workshop participants noted online initiatives targeting TPD. For example, ***KICD*** initiated the ***elimika***[25] online TPD program in 2016. This program trains teachers through a self-paced online on pedagogical approaches in curriculum implementation. And, teachers are encouraged to register for the courses anytime through a whitelisted platform on the ***Kenya Education Cloud***[26] that allows teachers and education managers of public and private education institutions to undertake the courses. Both are powered by Moddle. Further, the ***Kenya Teachers Service Commission (TSC)*** developed TPD courses, using ICT for subject delivery and to sensitize teachers on emerging technologies, and accredited teacher training institutions, including universities, to run them. TSC recognizes the TPD courses as part of teacher management and career progression.

Emerging Assessment and Data Generation

Many of the informants indicated that they are working with assessment and data tools for improving learning, which they say are pivotal for enhancing learning experiences, personalizing education, and improving teaching practices. In 2024, the

[24] https://www.hempelfonden.dk/en/what-we-do/education/eof-sierra-leone/

[25] https://elimika.kec.ac.ke/

[26] https://kec.ac.ke/

Kenya National Examination Council (KNEC) started its Research Innovation and Learning Assessment Centre to consolidate and nurture innovations in learning assessment.

Assessment and data tools are pivotal for enhancing learning experiences, personalizing education, and improving teaching practices.

One example is ***The Digital School***, which operates under the auspices of the ***Mohammed bin Rashid Al Maktoum Global Initiatives***[27] and is working in five initial countries: ***Colombia***, ***Egypt***, ***Iraq***, ***Jordan***, and ***Mauritania***. The Digital School provides accessible digital education primarily to students in underserved communities, refugees, and displaced persons. Its platforms incorporate tools that provide real-time feedback on student performance. As Dr. Waleed Al Ali, Secretary General of The Digital School, shared that this platform allows educators to quickly identify areas where students may be struggling, enabling timely interventions. For instance, online formative assessments through quizzes and interactive tasks help track progress continuously rather than waiting for end-of-term evaluations. ***Data*** collected from assessments are also being used to create personalized learning experiences. By analyzing student performance and learning behaviors, educational technologies can adapt content and learning paths to meet individual needs; this is particularly beneficial for accommodating diverse learning styles and paces.

EIDU employs digital tools that empower local and national education authorities with robust data analytics capabilities for continuous monitoring of student learning outcomes and informed decision-making. Ms. Nina Bolte, Head of Learning at EIDU, explained that the platform uses ***internationally validated assessment tools***, such as the Early Grade Mathematics Assessment (EGMA) and the Early Grade Reading Assessment (EGRA), to track children's learning progress on a daily basis. This data collection is crucial for identifying effective educational practices and improving teaching strategies. By collaborating with county governments and other stakeholders, EIDU supports the implementation of digital learning programs that include training teachers in data monitoring and evaluation. For example, in Embu County, ***Kenya***, the local education authority collaborates with EIDU to assess learning outcomes across numerous ***early childhood development education centers***. This partnership aims to create a comprehensive digital assurance system that not only tracks assessments, but also informs policy-making and enhances educational practices.

All informants interviewed emphasized a range of persistent challenges in effectively reaching rural and isolated regions.

Noteworthy digital courseware examples identified through KIIs are featured above. However, all informants interviewed emphasized a range of persistent challenges in effectively reaching rural and isolated regions. Specific examples of barriers to expansion are provided under *Challenges to Implementing the Ideal Digital Courseware*.

[27] https://www.almaktouminitiatives.org/en

Vision of Ideal Digital Courseware

Overarching Vision for an Ideal Digital Courseware Ecosystem

- Creates a more-responsive, engaging, and equitable educational landscape that prepares learners for a rapidly changing world
- Aligns digital content with national curricula and teaching pedagogies
- Offers digital learning for the hearing and visually impaired
- Allows learners to access content without license or payment for registration

Most informants described a vision of a digital courseware ecosystem that creates a more-responsive, engaging, and equitable educational landscape and that prepares learners for a rapidly changing world. They advocated for the integration of digital solutions into traditional education systems, thus creating hybrid models that enhance teacher-based instruction and extend learning beyond the classroom. Informants such as Mr. Florencia Ceballos, Senior Program Specialist at ***International Development Research Centre (IDRC)***, recognized the steep hill ahead in addressing limited access, although much of this work is not directly within the purview of the education sector. Informants emphasized the urgent need to leverage technology to ensure resilience in education against interruptions and disruptions, such as pandemics, climate change, and conflicts.

Informants from ***Kenya***, ***The Gambia***, ***Ghana***, and ***Malawi*** expressed similar visions about the importance of aligning digital content with national curricula and teaching pedagogies. This included the need for increased financial and technical support to procure and build out the necessary digital infrastructure (e.g., provide and maintain devices, connectivity to schools, training) and to scale promising and impactful digital initiatives beyond pilot programs.

Mr. John Oyuga, Deputy Coordinator at NIC3, suggested the implementation of some variation of both offline and online models for all primary and secondary education, including pre-service and in-service teacher education, to reach more teachers and learners. Many workshop participants highlighted the need for digital learning for the hearing and visually impaired.

Informants from some of the countries highlighted a vision where there is clarity on OERs and perpetual licenses for proprietary digital content. The need for learners to access content without license or payment for registration was emphasized across the board through the workshop participants and the KIIs.

"Vision" themes of key informants are grouped into four areas:

- Hybrid technology and traditional teacher-led instruction
- Large, free digital courseware resource library
- Data for insights and continuous learning
- Safe digital environment

Hybrid Technology and Traditional Teacher-Led Instruction

Many informants stressed the important and promising role of digital tools for enhancing learning, but not necessarily as a substitute for the value of effective in-person teaching. Still, many informants recognized the unmatched value and opportunity of digital learning in rural communities, areas of conflict, and in refugee settlements.

For example, ***VVOB | education for development***[28] is actively promoting this vision by incorporating blended learning strategies to strengthen education through continuous professional development for educators and school leaders in many countries in Africa, starting with ***Kenya***. VVOB has partnered with the ***Kenya Education Management Institute*** to design a blended learning program for school leaders, aimed at enhancing their ability to implement the country's CBC. This initiative, known as the ***INCREASE program***,[29] combines in-person sessions with an app-based learning platform, allowing for self-paced modules, interactive sessions, and digital feedback loops. As Mr. Jef Peeraer, Global Strategic Education Advisor for VVOB explains, the program's flexibility helps school leaders balance learning with their professional responsibilities, enabling them to foster an inclusive, learner-centered environment for teachers and students.

There is an urgent need to leverage technology to ensure resilience in education against interruptions and disruptions.

The ***IDRC*** is also actively promoting evidence-based hybrid learning approaches that combine both digital and in-person methods to enhance educational accessibility, particularly in low- and middle-income countries.[30] IDRC is partnering with local organizations to study the effectiveness of this model and evaluate how they can support educational recovery. The research effort involves ***collaborative "learning journeys"*** that allow educators and stakeholders to share insights on hybrid learning's role in maintaining student engagement and improving learning outcomes. This method encourages reflection on effective hybrid strategies, balancing technology with essential in-person elements, which is vital for adaptation in rapidly changing conditions.

Large, Free Digital Courseware Resource Library

Many informants expressed a desire for a large free or low-cost digital courseware resource library. Mr. Mark West, UNESCO Education Specialist, described models such as UNESCO's support of large, free digital courseware resource libraries through various initiatives, most notably the ***Gateways to Public Digital Learning program***[31] that

[28] https://www.vvob.org/en

[29] https://www.vvob.org/en/programmes/kenya-increase-supports-implementation-competence-based-curriculum

[30] https://idrc-crdi.ca/en?gad_source=1&gclid=Cj0KCQiA3sq6BhD2ARIsAJ8MRwUNv2mmcnecQOYwIyw_p0eNnHuADenCProC0Tf58kpXqVPLteW7AcUaAitOEALw_wcB

[31] https://www.unesco.org/sites/default/files/medias/fichiers/2023/12/Gateways%20to%20Public%20Digital%20Learning%20Initiative0.pdf

aims to make high-quality digital education content a public good by supporting countries in building inclusive and equitable digital learning platforms. The current communities of practice (COPs) cover more than 30 countries, including ***Bulgaria***, ***Egypt***, ***Finland***, ***Jordan***, ***Mongolia***, ***Singapore***, and ***Uruguay***. This initiative involves sharing resources, best practices, and technical expertise to help countries establish and improve digital education infrastructure, particularly in underserved areas.

Many informants expressed a desire for a large free or low-cost digital courseware resource library. This interoperable platform could be accessed on a variety of devices, including mobile phones, tablets, and computers.

Other informants shared a goal to ensure that anyone, regardless of socioeconomic status, geographic location, or educational background, could access the quality and standardized materials for free or low cost. To serve this objective, they call for an interoperable platform that could be accessed on a variety of devices, including mobile phones, tablets, and computers. Some also pointed to technologies that provide classrooms with free internet with ***offline-first capabilities***. The envisioned library would offer resources across a wide range of subjects, from core academic topics like mathematics, science, and literacy to vocational training, life skills, and arts. This would ensure that learners have access to materials that suit their interests, goals, and stages of development. A continental or global resource library would need to include content that's been ***adapted for different languages, cultural contexts, and educational standards***.

Over the short and long terms, informants suggested the library would take advantage of AI-driven technology to create ***personalized learning paths***, tailoring content to meet the learner's pace, strengths, and areas for improvement. This would allow each user to progress through lessons in a way that maximizes understanding and retention. Resources could include video lessons, interactive quizzes, e-books, podcasts, and simulations to cater to different learning styles. This multimedia approach would help engage diverse learners, including those who might struggle with traditional reading-based materials and those with disabilities.

In addition to student resources, the library would provide materials designed to support teachers, such as ready-made lesson plan guides, classroom activities, assessments, and professional development resources. This would help teachers deliver effective lessons and bridge learning gaps.

A few informants were already working in this area. ***Education Above All Foundation's Internet-Free Education Resource Bank***[32] is one such recognized tool. It features more than 500 learning resources designed for hands-on, project-based learning and is designed for students in low-resource settings, providing a way to maintain education continuity, even when technology and connectivity are sparse.

A major obstacle to digital inclusivity and open access is that digital content developers need to be compensated for their work.

An obstacle that would need to be addressed in meeting this vision is the perspective of digital content developers that depend on funding to sustain their work. There would likely be significant push-back from developers who do not receive remuneration for and/or do not have a sustainable funding model.

[32] https://www.educationaboveall.org/our-work/our-projects/internet-free-education-resource-bank-iferb

Data and Insights for Continuous Improvement

Informants highlighted the ability to use digital learning resources within a school local digital network/system. This ideal platform would integrate digital learning resources, student data and assessment to personalize learning and monitor progress, as well as analyze aggregated learning. Through continuous assessment, the platform would collect data on each learner's strengths, weaknesses, and learning preferences. This would allow the platform to adjust the content and difficulty level dynamically. The platform would use formative assessments, like quizzes, short exercises, or interactive tasks, to provide immediate feedback to learners and teachers.

Mr. Moduo Sowe, ***The Gambia Minister of Basic and Secondary Education***, stressed the need to improve data management through institutionalized digital platforms. The platforms should be designed to offer learning resources within institutional LANs and only link to the Ministry's wide area network (WAN) to provide free access to content and secured student data. He believes this would be best done by working with a "single company" to maintain a protected virtual private network (VPN).

An Ideal Digital Learning Platform

- Collects data from learners
- Uses data to adjust content and difficulty level dynamically
- Populates a dashboard that provides teachers with insight into students' challenges and successes
- Provides suggestions for useful content

The informants envisioned courseware that would be measured through user feedback, especially from learners and teachers, and through monitoring mechanisms that assess the adequacy of infrastructure, devices, and content adaptation. A detailed analytics dashboard would allow educators to track individual and group performance. These ***data insights*** would help teachers identify trends in areas where most students struggle. Teachers are able to tailor their lessons or provide targeted support to address these specific needs. By identifying patterns, the platform could even suggest resources or activities that have previously improved performance for similar learners. Built-in analytics would provide students with insights on their progress, help them track their strengths and identify areas that need more focus. This feedback loop would further encourage sustained engagement and motivation.

One example of at least part of the ideal platform is ***Edraak***. As a MOOC platform, it uses data analytics to track learner engagement and performance. It collects data on user progress, course completion rates, and assessment results. Mr. David Lazaro, Edraak's Director, explained that this information helps in identifying learning trends, tailoring content to user needs, and improving course design. Edraak's data-driven insights are used to enhance the user experience and optimize educational outcomes for its Arabic-speaking audience.

EIDU also collects real-time data on learners' interactions with its platform, such as progress in literacy and numeracy skills. This data is used to personalize learning experiences and guide teacher interventions. Additionally, the platform includes built-in assessments, which provide anonymized insights into learning outcomes. These data points are synchronized to EIDU's central dashboard, allowing for continuous

monitoring and refinement of teaching strategies. Governments and schools use these insights to make data-driven decisions aimed at improving education quality.

Safe Digital Environment

Many informants emphasized the need to ***protect the privacy and security of students***, especially children. The envisioned platform would need to adhere to strict data privacy standards and policies to ensure that student data is safe and used ethically. Many informants called for the platform to be non-commercial, avoiding advertisements and ensuring that all content is free from bias. This also reinforces the mission of ***equal access and a distraction-free learning environment***.

UNESCO is already promoting secure data practices globally in digital learning systems to protect students' privacy and ensure safe educational environments through its published resources, like the ***Personal Data Security Technical Guide for Online Education Platforms***,[33] which provides strategies for safeguarding personal information. This guide encourages educational stakeholders to implement security protocols before, during, and after online learning sessions, prioritizing data protection to foster a safe digital landscape for learners worldwide.

Challenges to Implementing the Ideal Digital Courseware

While informants generally agreed that digital platforms in low-resource countries have made strides in expanding educational access, they also reported significant challenges to achieving the “ideal”.

The barriers identified fell into seven areas:

- Limited infrastructure, connectivity, and off-line first solutions
- Lack of inter-operability
- Lack of quality assurance standards
- Inadequate accommodations for culture and language differences
- Insufficient access to and use of data
- Lack of financial resources
- Inadequate equity and inclusion standards

[33] https://unesdoc.unesco.org/ark:/48223/pf0000373892.locale=en

Limited Infrastructure, Connectivity, and Offline First Solutions

All interviewees referenced the challenges of ***poor infrastructure and connectivity*** for equitable access to digital courseware. They also realize that infrastructure for connectivity and power are much bigger issues for their countries and beyond the scope of the education partners. Still, for illustration purposes, according to Dr. Chomora Mikeka, Malawi's Director of Science, Technology, and Innovation, only 2% of the primary schools in ***Malawi*** (i.e., 140 of nearly 7,000 primary schools) are connected to the internet. Informants pointed to issues such as high costs of internet access, low rates of internet usage despite coverage, and a significant digital gender gap. Informants also shared how many of the schools in which they work or support lack adequate physical spaces, such as computer labs or classrooms, and the necessary technical support to maintain and troubleshoot digital devices, software, and connectivity issues.

There are some piloting efforts being developed as ***"workarounds" to connectivity***.

- In ***Ghana***, Ms. Victoria Anisha, STEM Coordinator with ***GES,*** described connectivity as one of the country's greatest challenges due to the number of isolated rural villages. She further shares Ghana is considering setting up each school as a hub as a means of focusing connectivity.
- The ***JBJ Foundation*** is piloting an approach that involves adapting educational content to local contexts and utilizing existing infrastructure like radio, television, and solar-powered technology for distribution. In ***Malawi***, JBJ Foundation is currently collaborating with the nonprofit ***Ubongo***,[34] which creates educational content in local languages like Chichewa. Through television and radio broadcasts, JBJ Foundation and Ubongo have reached a broad audience at low costs, effectively promoting early learning and literacy in both formal and informal educational settings.
- ***Malawi*** government officials are also exploring options for use of low-cost mobile phones to deliver scripted educational content to teachers and students by use of unstructured supplementary service data (USSD) command prompts.[35]

Participants in the digital courseware workshop pointed to ***challenges in funding that are related to infrastructure***, which some dimensions are outside the purview of the education sector. Funding for digital courseware is done mainly by the government. The private sector and other stakeholders have complemented the government input. However, some gaps include inadequate funding for digital courseware infrastructure, maintenance and updating of digital courseware, and absence of regular, sustainable financing models that can support planning.

[34] https://www.ubongo.org/

[35] https://inspirelearnmw.com/learning-on-basic-phones/

Connectivity is a major challenge, with facets related to internet coverage, infrastructure costs, and equal access. Lack of connectivity can lead to outdated content and greater digital divides.

Many informants described the use of offline-first devices to address connectivity challenges by enabling functionality and usability even when internet access is unavailable or unreliable. ***JBJ Foundation*** has adopted an offline-first approach to enhance the accessibility and usability of digital resources in areas with limited or unreliable internet connectivity.

While offline-first approaches are vital workarounds in many low-resource settings, some informants pointed out that these solutions can also create barriers to accessing and using digital courseware. In some cases, users do not allow ***regular connection time for real-time updates*** to courseware. With an offline model, content can become outdated, and students and teachers may miss access to new resources, learning materials, or educational applications, which are typically updated regularly online.

Online platforms typically use data to monitor student progress, provide tailored feedback, and generate reports. Offline-first devices must be connected regularly to data management systems and other cloud-based resources. If not connected regularly, there can be a lack of timely insight into student performance, making it harder for educators to adjust teaching methods or offer personalized interventions.

Lack of Interoperability

More than two-thirds of the informants noted the lack of interoperability as a barrier to ***expansion and scale***. This issue arises from the need for various educational technologies, platforms, and devices to work together seamlessly, which is often not the case in these environments. Many digital learning solutions, such as LMSs, content delivery platforms, and assessment tools, are developed by different organizations or companies, often without standardized protocols for integration.

In low-resource countries, where access to technology is already limited, having a fragmented ecosystem means that schools and learners struggle to use different tools together. For instance, an offline-first device might not sync easily with a particular online platform, or digital resources may not be compatible across different operating systems when in different devices and/or different operating systems.

Mr. Jian Xu, Senior Education Specialist with the ***Asian Development Bank (ADB)***, noted that regions with diverse educational needs and tech infrastructure often lack ***global standards*** for digital learning platforms, which can impede interoperability. When content and tools cannot easily share data or synchronize across devices, creating cohesive, scalable digital education solutions becomes more difficult. For instance, efforts to introduce OERs can be hindered if the platforms used by different schools are not compatible.

The ***ADB*** is actively supporting solutions that promote open-source standards, data-sharing protocols, and cross-platforms. ***Digital Agenda 2030***[36] outlines ADB's strategy on the use of technology, including open data and open-source solutions, to enhance governance and service delivery. The ADB pushes the use of ***open-source software and data-sharing protocols*** to enable access to educational content without being locked into proprietary systems. This approach further fosters collaboration and resource-sharing in the field, which, in turn, supports cross-platform compatibility so that digital tools and courseware can be accessed across various devices and operating systems, making digital learning more accessible to people in low-resource settings.

Lack of Quality Assurance Standards

Participants in the digital courseware workshop agreed that more needs to be done around standards for quality assurance and approval of digital courseware. Currently, standards are segregated and are not up to date with current dynamic needs. Standards must also focus on ***accessibilities***, particularly for learners with disabilities. Kenya applies ***Universal Design for Learning (UDL)***[37] principles to ensure that digital content is accessible to a broad spectrum of learners, including those with physical, sensory, and visual impairments.

Workshop participants felt that ***digital courseware standards*** should prioritize accessibility, affordability, interoperability, and adaptability to local contexts. And, Dr. Barbara Glover of the African Union Development Agency (AUDA-NEPAD) expressed the need to have standards based EdTech solutions across the areas of infrastructure, content and skills particularly for scaling in primary and secondary education and technical and vocational education and training (TVET). These standards should apply to materials across various devices, especially mobile phones and tablets because mobile access is more common than broadband internet. These standards should offer governance, guidance, and benchmarks to what the learners need to access and regulated by education managers. Open access to the standards established allows the developers to self-quality-assure during the solution development stage.

Attitudinal Barriers

An additional set barriers worth noting came from a Zambian representative: teachers' resistance to change, fear of technology complexity, negative attitude among learners, and perceived ineffectiveness. In Kenya, the Director/CEO of CEMASTEA, Ms. Jacinta Akatsa, explained that:

"Teachers are at various stages of using ICT in their pedagogical approaches particularly in the teaching of STEM. While some are at the level of innovation laggards in use of technology with high levels of technophobia, others are highly innovative champions and peer trainers in active [COPs]."

[36] https://www.adb.org/documents/digital-agenda-2030-special-capital-expenditure-requirements-2019-2023

[37] https://aphrc.org/blogarticle/inclusive-education-in-kenya-what-the-universal-design-for-learning-can-offer/

Inadequate Accommodations for Cultural and Language Differences

Many informants said that translating and culturally adapting digital courseware is a significant obstacle to scaling efforts and fitting the needs of different regions. By integrating cultural elements into digital courseware, countries can use education to preserve and promote their cultural heritage and identity, fostering pride and continuity among future generations. Informants pointed out that addressing this matter can be resource intensive and time consuming.

> *"There is a imperative need for local digital content that reflects the Gambian context, ensuring content is meaningful and relatable to learners. When students see their lives, languages, and traditions reflected in learning materials, they are more likely to engage with and retain the content."*
>
> – Mr. Momodou Jeng, Director of CREDD

For example, respondents from ***The Gambia*** pointed to a strong need to develop local digital content that reflects the Gambian context, ensuring content is meaningful and relatable to learners. Mr. Momoduo Jeng, Director of the ***Curriculum Research Development and Assessment Directorate (CREDD)***, explained that when students see their lives, languages, and traditions reflected in learning materials, they are more likely to engage with and retain the content. Mr. David Bawa, National Coordinator with ***GES***, also emphasized that digital courseware must be highly relevant, incorporating indigenous content that reflects the country's unique cultural and educational needs, while also being interactive to engage learners more effectively.

Ms. Sara Wragg, Head of Innovation Education at ***Education Above All***, shared that the organization is addressing language and cultural barriers in digital learning primarily by promoting multilingual education, especially education in learners' mother tongues and languages of the catchments areas in pre-school learning. Mr. Mark West, Education Specialist at ***UNESCO***, conferred that learning in a native language significantly improves comprehension, engagement, and retention, fostering a more-inclusive environment for students from diverse backgrounds.

Insufficient Data Access, Use, and Security

Data can help tailor educational interventions, improve resource allocation, and track learning outcomes. However, as the majority of informants pointed out, the infrastructure, capacity, and systemic support required for proper data use are often lacking in low-resource settings.

In some successful cases, ministries and implementers use data to create ***adaptive learning environments***. For example, organizations like ***Imagine Worldwide*** use continuous data collection to assess and adjust learning interventions in real time. By tracking literacy and numeracy progress, organizations can tailor content to student needs and provide more targeted support. This data-driven approach has shown

positive results, especially in ***Malawi***, which observed significant gains in foundational skills even amid challenges, like COVID-19 disruptions.

Data can serve many functions in digital learning, including assessing and adjusting learning interventions, monitoring educational outcomes. However, collecting data as often and thoroughly as is needed for these functions is difficult due to low connectivity and data security concerns.

UNESCO supports using data to monitor educational outcomes and to determine where additional resources are needed. This data has been vital for tracking progress toward ***international educational goals*** (e.g., Sustainable Development Goal 4, which aims for inclusive and quality education). The data collected helps identify specific regional or demographic disparities and enables NGOs and governments to effectively prioritize under-resourced areas. However, internet connectivity, reliable electricity, and device access are often inconsistent in low-resource areas, making data collection challenging. Data cannot be collected or updated as frequently as needed for real-time monitoring and personalized learning.

Several of the informants noted concerns about ***data privacy and security***, especially where personal student data is collected. In particular, participants in the Kenya Digital Courseware Workshop noted that the MoE's ***Kenyan Education Management Information System (KEMIS)***[38] has personal identity data on more than 40 million Kenyans, including approximately 20 million students and their parents and guardians. Without robust policies and secure digital infrastructures, sensitive information could be at risk, complicating the broader adoption of data-driven approaches in certain countries. Key informants from ***Malawi*** and ***Rwanda*** also expressed the need for data security and use of data to inform decisions. They further shared that their countries are developing policies for data management, such as Malawi's Data Protection Act and online Child Protection Act that cover issues of cyber security.

Finally, it was noted that many local educators and education administrators often lack ***training in data analysis and digital literacy***, making it difficult to effectively interpret and act on data insights. Some informants are working to address this gap, but progress varies significantly by region.

Lack of Financial Resources

Given the barriers to achieving scale and sustainability, all informants highlighted insufficient funding for digital courseware as a major constraint. Costs associated with purchasing devices, acquiring software licenses, and maintaining digital infrastructure can be prohibitive for many national and local stakeholders, including schools and parents, especially in low-resource settings. Funding for digital courseware is often unevenly distributed, with schools in wealthier areas having more resources than those in underserved communities.

[38] https://kutv.co.ke/ministry-of-education-introduces-kenya-education-management-system-kemis-to-centralize-and-streamline-educational-data/

Inadequate Equity and Inclusivity Standards

Participants at the digital courseware workshop and other key informants stressed the continued existence of a wide digital divide between students from different socioeconomic backgrounds that exacerbate ***educational inequalities***. Organizations are using several approaches to bring digital learning to low-resource countries, combining technology access, localized content, and support systems for sustainable impact. But, informants from these organizations warn of the work ahead.

Adequately addressing digital inclusivity issues requires coordinated action in platform design, teacher training, and resource development.

The ***World Economic Forum*** estimated in 2021 that while digital inclusion is expanding, only about 40% of African youth ages 15–24 years have the ability to access the internet either regularly or occasionally, based on infrastructure, affordability, and connectivity, rather than how often they actually go online.[39] Among school-aged children, this figure is significantly lower, with ***vast rural-urban divides*** in connectivity and access to devices. The COVID-19 pandemic accelerated digital engagement for some children, but challenges persist in infrastructure, affordability, and digital literacy.

Many country informants pointed out that digital learning is sometimes and unintentionally ***isolating for students with disabilities***. Digital learning platforms often are not fully optimized for screen readers, voice commands, or other assistive technologies, making it difficult for students with visual, auditory, or motor impairments to access content. According to ***UNESCO***, this lack of accessible design restricts students from independently navigating online resources.

Kenyan informants highlighted barriers such as the high cost of assistive technologies; inadequacies in infrastructure and devices, especially in rural areas and special schools; and the lack of adequate content adaptation for learners with specific needs, such as hearing and vision impairments.

Efforts to create inclusive digital learning environments are ongoing, but addressing these issues requires coordinated action in platform design, teacher training, and resource development to ensure equitable access for all students. Ensuring that digital courseware is accessible to students with disabilities or special needs requires adherence to accessibility standards, which are not always prioritized in the design process.

[39] African Youth Survey 2022, conducted by the Ichikowitz Family Foundation, provides relevant insights. This survey found that 36% of African youth ages 18–24 have regular access to the internet, while 9% have occasional access, totaling 45% with some level of internet access. This data is based on factors such as infrastructure, affordability, and connectivity. See: https://ichikowitzfoundation.com/storage/ays/ays2022.pdf?utm_source=chatgpt.com.

Policies and Legislation

Government officers highlighted the critical role of national and regional policies in shaping the trajectory of digital education, with these frameworks either facilitating progress or slowing down the growth of education technology. In 2021, during the ***Innovation Africa Global Summit***,[40] Mr. John Kimotho, then-Director of Educational Media in ***Kenya***, observed that during the peak period of COVID-19, practice went ahead of policy in the edtech industry. Practices such as use of social media and mobile phones for education were not anchored in policy, yet they thrived in many African countries during this time.

Key informants Mr. Nathaniel Cisco from ***Liberia*** and Dr. Chomoro Mikeka from ***Malawi*** similarly concurred that in many cases, ***broader ICT policies*** originating from ministries of technology or communication indirectly or directly referenced education, but primarily emphasized infrastructure development, such as device technical specifications and distribution, expanding internet connectivity, and e-waste management. While these initiatives are foundational, they often lacked specific provisions for education-focused outcomes, including criteria for identifying, selecting, and supporting training in digital courseware.

Informants from ***Kenya***, ***Rwanda***, and ***The Gambia*** stressed the value of ICT policies developed by MoEs that take into consideration the services of diverse educational units and the interests of populations administering and served by the educational ecosystem. Such policies try to prioritize expanding access to digital tools, aligning digital courseware with national curriculum standards, and enhancing teacher training and capacity to integrate technology into classrooms. The greater familiarity of authors and implementers of such edtech policies makes it easier to integrate emerging technologies (e.g., AI, Internet of Things [IOT]) and new opportunities than in the absence of such foundational strategy documents. However, such policies frequently fall short of addressing the ***practicalities of implementation*** due to a mismatch between needed resources and government administrations changes. These same policy-makers stressed the importance of a ***continuity of a shared vision*** for digital access and content provision over time to meet targets of edtech implementation plans, which can be monitored and mitigated for success.

To better support the scaling of digital education in Africa, informants suggested that policies should address systemic barriers and create an enabling environment for widespread adoption. Several of the informants highlighted specific policy areas for transforming the use and access to digital courseware resources, including:

- Expanded infrastructure
- Teacher training and professional development
- Alignment of digital courseware with curriculum standards
- Compliance with regulations
- Edtech public-private partnerships
- Licensing and costs

[40] https://innovation-africa.org/2025/

Regional and National Policy Observations

Key informants highlighted that the benefits of digital courseware access and lost opportunities without robust access to such resources are being advanced in regional platforms and national initiatives in Africa. For example, the ***African Union's Continental Education Strategy for Africa (CESA 2016–2025)***[41] contains references to promoting "the development of online contents taking into account African and local specificities" and to creating "mobile and online education and training platforms and accessibility to all students regardless of their circumstances".

Several digital courseware initiatives were featured during the ***Continental Conference on Transforming STEM in Africa***.[42] With the ***World Economic Forum's Future of Jobs Report 2023***[43] indicating that Africa needs an additional 23 million STEM graduates by 2030 to meet demand in engineering, healthcare, and information technology (IT), this conference was timely in stressing the importance of, among other topics, youth as catalysts for science, technology, and innovation transformation, equitable access to STEM resources, bridging the digital divide in STEM education, and the importance of public-private partnerships (PPPs) for STEM.

Some of the ***specific national ICT in education policies*** referenced by key informants are highlighted below.

- ***Kenya's ICT in Education Policy***,[44] part of the broader Digital Economy Blueprint, outlines strategies for incorporating digital tools to improve access, quality, and equity in education. This policy emphasizes the development of digital infrastructure. Several participants in the digital courseware workshop commented that Kenya's ICT in education policy is notable because it embraces opportunities for public and private sector collaboration, which can accelerate the local edtech industry's response to demand for access to high-quality learning content and seed youth digital skills development.
- ***Kenya***'s education policies actively address digital learning through several initiatives and frameworks. Key among these is the ***DLP***,[45] which integrates technology into the classroom environment for primary school students. The program aims to enhance national digital literacy levels, while contributing to Kenya's broader digital economy goals. Under DLP, students receive tablets and teachers are equipped with laptops, enabling interactive digital learning experiences. More than 75,000 teachers have been trained to facilitate this transition.

[41] https://ecosocc.au.int/sites/default/files/files/2021-09/continental-strategy-education-africa-english.pdf

[42] https://www.unesco.org/en/conference-stem-africa

[43] https://www.weforum.org/publications/the-future-of-jobs-report-2023/

[44] https://www.education.go.ke/sites/default/files/2023-01/ICT%20IN%20EDUCATION%20AND%20TRAINING%20POLICY%202021.pdf

[45] https://www.digischool.go.ke/

DLP Global Best Practices for Digital Content Provision

- Engage with publishers on the provision of digital content and services to support the curriculum, including services appropriate for special education.
- Enable schools, teachers, and students to access quality assured open digital content from educational content providers.
- Develop strategic partnerships with relevant cultural, educational, and sporting bodies in order to adapt relevant content into useful learning and teaching resources.
- Develop and promote protocols on sharing of digital resources between providers of professional support for schools.

- According to Dr. Mikeka, ***Malawi*** is beginning to address more-detailed policies framed to govern digital education, including aspects of digital courseware adoption. The Malawi cabinet has already approved the policy on ***Higher Education, Open, Distance and e-learning Framework***.[46] There is also an ***ICT in education policy***,[47] which is still in development. Dr. Mikeka indicated that there is the *National Science and Technology Policy* that was scheduled for launch by the president in 2024.
- ***Ghana's ICT policy***[48] aligns with the nation's ***Education Strategic Plan 2018–2030***[49] and is part of broader education reforms. The policy underscores the importance of integrating technology into teaching and learning processes to enhance educational outcomes. Ghana's ***ICT in education policy*** emphasizes the integration of digital tools to enhance learning outcomes and prepare students for the demands of a technology-driven world. Key elements for this policy include ICT skills development among pre-tertiary learners and teachers, fostering an early interest in technology use. Additionally, the plan incorporates technology into teaching methods and provides digital resources for both educators and students. Reforms led by the ***National Council for Curriculum and Assessment (NaCCA)***, the education system is integrating ICT into pre-tertiary education with standards and assessment frameworks to ensure that students are prepared for a global digital economy.
- ***The Gambia*** has several policies and initiatives that promote digital literacy in education. For example, digital literacy is part of the ***Education Sector Policy 2016–2030***.[50] The ***National Development Plan 2018–2021***,[51] which aimed to transform the country into a digital nation and demanded a technologically literate population and sectoral policies supporting these strategic objectives, recognized youth

[46] https://www.nche.ac.mw/images/ACCREDITATION/FRAMEWORKS/HIGHER_EDUCATION_OPEN_DISTANCE_AND__e-LEARNING_ODEL_FRAMEWORK.pdf

[47] https://npc.mw/wp-content/uploads/2020/07/national_ict.pdf

[48] https://nita.gov.gh/theevooc/2017/12/Ghana-ICT4AD-Policy.pdf

[49] https://www.globalpartnership.org/node/document/download?file=document/file/2019-05-education-strategic-plan-2018-2030.pdf

[50] http://www.rodra.co.za/images/countries/gambia/policies/Education%20Policy%202016-2030.pdf

[51] https://www.fao.org/faolex/results/details/en/c/LEX-FAOC184392/

empowerment as one of its strategic priorities and ICT as a critical enabler. In this direction, various policies and plans have been developed, including the ***Education Sector Strategic Plan (2016–2030)***, the ***National Employment Policy and Implementation Plan (2019–2024)***,[52] the ***Technical and Vocational Education and Training (TVET) Roadmap (2020–2024)***,[53] ***Information and Communication Technology for Development (ICT4D) Policy (2018–2028)***,[54] and the ***Cybersecurity Policy (2020–2024)***.[55]

Regarding the ***Education Sector Policy 2016–2030***, it includes review of the education sector to imbibe digital literacy and ICT skills and strategies to address the key challenges hindering ICT education, such as lack of a standardized ICT curriculum for all levels of schooling; tackle the high attrition rate among teachers with ICT skills; and ensure supply of ICT infrastructure and electricity to schools. Unfortunately, the policy is an example of implementation issues not being directly addressed, particularly in relation to digital content development. The existing policy is managed by the Ministry of Communication and Digital Economy and does include reference for ICT integration in education. Further legislation support is needed to enhance digital content development and accessibility, particularly for learners with special needs.

- Ms. Diane Sengati of the ***Rwanda*** Education Board (REB) explained that the country had an ***ICT in education policy,***[56] but it has expired. The policy served as an initial guiding framework for integrating technology into education. A ***new edtech policy*** is being developed in collaboration with the World Bank and other stakeholders. The aim is to create a more-modern framework to support the digital transformation in education. The policy will focus specifically on edtech, rather than ICT generally, and will include updates and improvements based on lessons learned from the previous policy.
- ***Tanzania*** has a ***national ICT in education strategy***[57] that aims to integrate ICT into all levels of education to improve the quality of teaching and learning in the country. The strategy outlines how ICT should be adopted and used to improve education and training across all levels. Mr. Jonathan Hegwa Paskali of TIE indicated that some challenges are due to issues related to infrastructure and the cost of power and data.

[52] https://dspd.forte-data.com/d/caa8474d-5bad-11ec-9b31-029254d29bb1

[53] https://nyc.gm/wp-content/uploads/2020/04/Youth-and-Trade-Road-Map-TVET-Sector-2020-2024.pdf

[54] https://dspd.forte-data.com/f/caa6bc07-5bad-11ec-9b31-029254d29bb1

[55] https://dspd.forte-data.com/d/46499671-80c9-11ef-b086-029254d29bb1#:~:text=The%20policy%20shall%20ensure%20Gambia,and%20continuity%20of%20business%20operations

[56] https://planipolis.iiep.unesco.org/sites/default/files/ressources/rwanda_ict_in_education_policy_approved.pdf

[57] https://www.moe.go.tz/sites/default/files/Draft_National_Digital_Education_Strategy%202024-2030-2.pdf

Expand Infrastructure

Informants universally highlighted ***government interests and investments in digital infrastructure***. They stressed this as an area of additional innovation, particularly to support the expansion of broadband internet access, ensure affordable connectivity, and distribute low-cost devices to students and teachers, particularly targeted at rural and underserved regions. It was noted that policies that ***incentivize private sector involvement*** through tax breaks, grants, or PPPs can accelerate infrastructure development and technology deployment. For instance, aligning policy objectives with initiatives like ***Smart Africa***,[58] which aims to promote digital transformation across the continent, could foster more-cohesive efforts.

Teacher Training and Professional Development

Digital education policies must emphasize teacher training and curriculum integration to ensure the effective use of digital tools. Teachers are pivotal to the success of digital education, and policies should ***mandate professional development programs*** to equip educators with the necessary digital skills. Many educators lack the training and confidence to effectively integrate digital courseware into their teaching.

Professional development opportunities are often insufficient or not aligned with the needs of teachers. Mr. Nathaniel Cisco, ***Liberia***'s Deputy Minister of TVET; Mr. Francis Karanja, Head of NI3C in ***Kenya***; and Mr. Jonathan Hegwa Paskali, Curriculum Coordinator at TIE in ***Tanzania***, all expressed inadequacy in this area and the need for the development of more-supportive policies that offer practical teacher engagement with their devices and easy platforms.

Alignment of Digital Courseware with Curriculum Standards

Digital courseware may not always align with local curriculum standards or teaching practices, making it difficult for teachers to effectively integrate these resources into their lesson plans. Among the country informants, only ***Kenya*** and ***Rwanda*** indicated having published standards for a process for evaluating and approving digital courseware for K-12 education. Other key informants observed the need to develop and train on digital courseware standards that consider interoperability and align with national curriculum content and benchmarks of improvement.

[58] See https://smartafrica.org/. On 30–31 January 2014, The SMART Africa Manifesto was endorsed by all heads of state and governments in the African Union at the 22nd Ordinary Session of the Assembly of the African Union in Addis Ababa, Ethiopia. This development places the Manifesto at the heart of the ICT agenda in Africa beyond just the 7 original signatories at the Summit to all the 53 African countries. The SMART Africa Alliance has since grown to include 40 African countries that represent more than 1 billion people.

Supporting Localized Content

Governments should adopt inclusive frameworks that support localized content development in multiple languages to cater to diverse learners. Policies also must ensure that digital education aligns with national curricula and learning objectives to maintain quality and relevance. By embedding these strategies into comprehensive national and regional education plans, African countries can build scalable, sustainable digital education ecosystems.

For example, ***Kenya*** has published digital content standards for various categories of K-12 digital content. In ***Rwanda***, the standards are still being developed, and efforts are underway in ***Ghana*** to ensure digital content is aligned to the national curriculum. Meanwhile, in ***Malawi*** and ***Zambia***, basic standards for digital content are in place. ***Tanzania*** has dynamic (situational) standards, and ***The Gambia*** uses standards with minimum considerations, while ***Liberia*** has no standards for digital content. Although some countries align digital content with national curricula, others like ***Liberia*** and ***The Gambia*** lack clear or robust standards, presenting significant challenges.

Several policy-makers wondered if there could be ***continental digital course standards or guidelines***. They observed that such guidelines would support digital course sharing resulting in improved access and reduced costs.

Compliance with Regulations

Ensuring compliance with various data privacy laws, such as the ***General Data Protection Regulation (GDPR)***, the ***Family Educational Rights and Privacy Act (FERPA)***, and any local regulations, can be complex, especially when scaling across different countries. In ***Rwanda***, Ms. Diane Sengati, REB's ICT Director, and a number of other key informants were concerned with balancing student data privacy with meeting the need for data analytics for assessing learning outcomes.

Edtech Public-Private Partnerships

As previously noted, several informants highlighted the importance of PPPs to strengthen and deepen access to and use of high-quality educational digital content. This includes government and donors helping to evaluate and support identification of sustainable funding models of promising digital courseware by *both* non-profit and proprietary courseware providers. An example of the former includes the development and extension of ***eKitabu***'s inclusive digital courseware in ***Kenya***, ***Malawi***, and ***Rwanda***, which has been supported with USAID and UNICEF funding. Of the latter, the Mastercard Foundation, with its support of edtech hubs in Africa, is building a network of edtech startups in Africa (12 in 2023, and another 12 in 2024). Several of these start-ups were featured at ***Mastercard Foundation's first edtech conference*** in July 2024 in Nigeria,[59] where they benefited from opportunities to dialogue with officials from several governments and donor agencies.

[59] https://mastercardfdn.org/our-work/events/edtech-conference-2024/

Licensing and Costs

Informants asserted that ***limiting the cost of digital courseware in low-resource countries*** is essential to ensuring equitable access to education. High prices can be a significant barrier for students and educators, preventing them from benefiting from quality learning materials. Informants supported more open-source platforms, mostly to ensure that they can avoid expensive licensing fees. Informants also felt that policies and practices that reduce costs for or even offer free or subsidized access to educational institutions, governments, and publishers could help bridge the digital divide and promote learning opportunities for all.

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Conclusions

The interviews and summarized insights provide a wealth of perspectives on current challenges, emerging opportunities, and strategies for strengthening digital courseware in low-resource countries. The authors would like to share some high-level takeaways from these discussions, highlighting key themes, innovative approaches, and actionable recommendations that emerged from the KIIs.

Strengthening Collaboration

Informants noted that while progress has been made, the digital courseware field still faces challenges in fostering collaboration among stakeholders. Unlike the medical field, where open sharing of research and best practices frequently spurs innovation, the digital courseware ecosystem, including those making key decisions and investments in this space, lack such structured platforms for exchanging ideas, methodologies, and measurable outcomes. This gap often leads to fragmented efforts that hinder the development of cohesive strategies and unified advancements in digital education. Strengthening dialogue and collaboration within the field is essential to overcome these challenges and realize its full potential.

This is particularly important for fostering alignment between policy objectives and on-the-ground initiatives, including lessons learned across countries, to ensure that efforts are complementary, rather than fragmented. Only by combining the strategic oversight of government entities and the global perspective of regional and global donors with the innovative approaches of implementers (both within and outside of government) can actors successfully address challenges like scalability, interoperability, and effective teacher capacity building. Merging opportunities for dialogue among these entities would help pave the way for sustainable, impactful

digital education solutions that demonstrate tangible and evidence-informed improvements on learning outcomes.

The mEA is keen to assist in such efforts, including using its unique global convening and community-building platforms, to foster such dialogue.

Subject-Specific Digital Courseware

The parameters established for the KIIs precluded the authors from going into too much detail and examination of digital courseware used for specific subject areas (e.g., literacy, numeracy, STEM). Without this information, all "digital courseware" would appear to be equally effective or ineffective, unless use is connected to tangible and evidence-supported measures of improvements in subject-specific learning outcomes. Because digital courseware decisions likely are informed by subject matter experts within governments, donors, and implementing organizations, ***mEA recommends that a representative body of such experts be included in future reports***.

As one contribution, ***mEA is well positioned to strengthen the collective knowledge exchange and networking of subject matter experts with digital courseware developers and platform providers***. This includes expanding the participation of such stakeholders in mEA subject-specific COPs, such as foundational numeracy (Math Power![60]) and literacy (Literacy League[61]), and in the global STEM education champions' COP, to be launched in 2025 and seeded by the innovators who have and will participate in a series of mEA symposia focused on this theme.

Private Sector Engagement

KIIs also did not include significant representation from private sector companies, including both platform and content providers and private school providers. Because there are many influential actors in this part of the digital courseware ecosystem, it would be valuable to include their voices in future discussions, as well. This is particularly relevant because policy-makers across various government and donor agencies typically also have interests in fostering private sector strengthening and youth entrepreneurship opportunities and there are significant opportunities for non- and for-profit partnership formation, blended financing, and scaling of promising digital courseware initiatives.

[60] https://meducationalliance.org/math-power/

[61] https://meducationalliance.org/literacy-league/

Appendix: Key Informants Interviewed

Please contact mEA for key informant profiles and transcripts of their interviews.

Country	Name	Title	Affiliation
Government			
Gambia	Mr. Modou Sowe	Minister of Basic and Secondary Education	Ministry of Basic and Secondary Education (MoBSE)
	Mr. Momodou Jeng	Director of Curriculum Resource and Development	
Ghana	Mr. David Bawa	National Coordinator Basic Education	Ministry of Education (MoE)
	Ms. Victoria Ansah	National STEM Coordinator	Ghana Education Services (GES)
	Mr. George Kwakye	National STEM Coordinator	
	Mr. Emmanuel Ocquaye	National STEM Coordinator	
Kenya	Mr. Francis Karanja	Head National ICT Innovation and Integration Center (NI3C)	Ministry of Education (MOE)
	Ms. Sheilah Lutta	Assistant Director of Education-SNE	
	Ms. Jacinta Akatsa	Director/CEO	Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA)
	Mr. John Oyuga	eLearning Department Head	
	Mr. Patrick Kogolla	Ag. Deputy Director Training	
Liberia	Mr. Nathaniel Cisco	Assistant Minister of STEM/TVET/Inclusive Education	Ministry of Education (MoE)
	Ms. Sangay Faeflen	Director of STEM Education	
Malawi	Dr. Chomora Mikeka	Director of Science, Technology and Innovation	Ministry of Education (MoEST)
	Dr. Joshua Valeta	Director of ODeL	
Rwanda	Ms. Diane Sengati	Head of ICT in Education Department	Rwanda Basic Education Board (REB)
Tanzania	Mr. Johnathan Hegwa Paskali	Curriculum Coordinator	Tanzania Institute of Education (TIE)

Country	Name	Title	Affiliation
Non-Government			
Canada	Mr. Florencio Ceballos	Senior Program Specialist, Knowledge Innovation Exchange Program (KIX)	International Development Research Centre (IDRC)
	Ms. Alejandra Vargas García	Senior Program Specialist, Education and Science Program	
Denmark	Ms. Anna Molgaard Thaysen	Manager of Education Partnerships	Hempel Foundation
Jordan	Mr. David Lazaro	Director	Edraak
Kenya	Ms. Nina Bolte	Head of Learning	EIDU
	Mr. Anthony Kahinga	CEO and Founder	Elimutab
	Mr. Michael Wachira	CEO and Founder, MCF Startups Programme	Mastercard Foundation
	Mr. Mark West	Education Specialist	UNESCO
	Ms. Lilian Kawira Mutegi	CEO and Founder	UpTyke Consulting Ltd.
Malawi	Mr. Joe Wolfe	Co-Founder and Co-CEO	Imagine Worldwide
	Mr. Jani Moliis	Strategy Manager	JBJ Foundation
Mexico	Ms. Mila Tonarelli	Innovation and Product Manager	ProFuturo
Philippines	Mr. Jian Xu	Senior Education Specialist	Asian Development Bank (ADB)
Qatar	Ms. Sarah Wragg	Head of Innovation Education	Education Above All Foundation
Tanzania	Dr. Lwidiko Mhamilawa	Director	ProjeKt Inspire
UAE	Dr. Waleed Al-Ali	Secretary-General	The Digital School
	Dr. Lesley Snowball	Educational Director	
	Mr. Barry Kruger	Advisor - Digital Learning	
Zambia	Ms. Marjolein Meande-Baltussen	Regional Advisor, Community Based Inclusive Development (CBID)	Christian Blind Mission (CBM) International
N/A	Mr. Jef Peeraer	Global Strategic Education Advisor	VVOB | education for development

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