RESEARCH PAPER

# The Impact of COVID-19 and FAIR Data Innovation on Distance Education in Africa

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## ABSTRACT

Prior to the advent of the COVID-19 pandemic, distance education, a mode of education that allows teaching and learning to occur beyond the walls of traditional classrooms using electronic media and online delivery practices, was not widely embraced as a credible alternative mode of delivering education, especially in Africa. In education, the pandemic, and the measures to contain it, created a need for virtual learning/teaching and showcased the potential of distance education. This article explores the potential of distance education with an emphasis on the role played by COVID-19, the technologies employed, and the benefits, as well as how data stewardship can enhance distance education. It also describes how distance education can make learning opportunities available to the less privileged, geographically displaced, dropouts, housewives, and even workers, enabling them to partake in education while being engaged in other productive aspects of life. A case study is provided on the Dutch Organisation for Internationalisation in Education (NUFFIC) Digital Innovation Skills Hub (DISH) project, which is implemented via distance education and targeted towards marginalised individuals such as refugees and displaced persons in Ethiopia,

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Somalia, and other conflict zones, aiming to provide them with critical and soft skills for remote work for financial remuneration. This case study shows that distance education is the way forward in education today, as it has the capability to reach millions of learners simultaneously, educating, lifting people out of poverty, and increasing productivity and yields, while ensuring that the world is a better place for future generations.

**ACRONYMS**

| | |
|---|---|
| AI | artificial intelligence |
| CBT | computer-based test |
| DISH | Digital Innovation Skills Hub |
| EdTech | educational technology |
| FAIR | Findable, Accessible, Interoperable, Reusable |
| LMS | learning management system |
| MOOC | massive open online course |
| NUFFIC | Dutch Organisation for Internationalisation in Education |
| ODL | open and distance learning |
| SCORM | Sharable Content Object Reference Model |
| VODAN | Virus Outbreak Data Network |

## 1. INTRODUCTION

Globally, more than 1.5 billion learners were shut out of the classroom when the COVID-19 pandemic triggered total or partial lockdowns, with many school campuses shutting to curb the spread of the virus [1]. To continue providing education, as well as mental support for learners, many academic institutions turned to distance education, in which teaching and learning are undertaken remotely on digital platforms. This has brought about a dramatic change in education, with the rise of e-learning platforms, virtual tutoring, video conferencing tools, and online learning software, among other things [2].

The irony of the situation is that several research pieces suggest that online learning provides increased retention of information for learners and takes less time, with flexibility in the learning and teaching process [3]. Distance education enables learners to learn anywhere and anytime, at their own convenience and pace. With the increased adoption of distance education, it is now evident that online learning will continue to exist post-pandemic, and even improve, which will have a massive impact on the education market worldwide. It is projected that online education will be valued at USD 350 billion by 2025, compared to USD 18.66 billion in 2019 [3]. This article presents the results of an exploratory desk study analysis of the prospects for, potential of, and technologies used in determining how content and assessment are delivered and made accessible to learners in distance education, with reference to the Dutch Organisation for Internationalisation in Education (NUFFIC) Digital Innovation Skills Hub (DISH) project as a case study.

The impact of COVID-19 on people's lives, work, livelihoods, education and the economy cannot be overstated. Although the pandemic has affected almost all sectors, some have been affected more than others, education being one of the sectors most affected. The livelihoods of workers in the sector have decreased, especially those working in private institutions. Survival has become the main goal for everyone. In addition to the economic problems caused by the pandemic, the psychological stress of the isolation and restrictions on movement has affected the mental wellbeing of many individuals, including teachers and students. As for children, who have been unable to go to school every day, the psychological impact has been enormous, placing additional stress on households and exposing them to new protection risks, including negative coping mechanisms.

This article explores the potential of distance education, with an emphasis on the role played by COVID-19, the technologies employed, and the benefits, as well as how innovations in data stewardship following the FAIR Guidelines – that data be 'Findable', 'Accessible' (under well-defined conditions), 'Interoperable' and 'Reusable' (FAIR) – can enhance distance education.

The FAIR Guidelines have become relevant due to the exponential growth of digital data and the necessity for machine-readable tools to help manage the growing amount of digital data. As distance learning will further contribute to this growth, including in new geographies such as in Africa, the management of digital data is an increasingly important area of study. The FAIR Guidelines, therefore, have relevance for education institutions (research) and services (for instance, in health), but how they apply to distance education has not yet been considered, to the best of our knowledge. One exception is the NUFFIC DISH distance learning programme, which is explored as a case study on the inclusion of innovation in distance learning.

This study adopted a participatory ethnographic design. The researchers participated in the NUFFIC DISH programme, including the integration of FAIR data within the curriculum. Some of the researchers also participated in the Virus Outbreak Data Network (VODAN)-Africa and VODAN-Asia, which aim at promoting the inclusion of FAIR Guidelines in health services. Required to perform critical reflexivity on the obstacles encountered in this process, the proximity of the researchers to the programme allowed them to realistically determine the possibility of integrating this innovation in distance learning modalities.

## 2. DEFINING DISTANCE EDUCATION

Distance education, also referred to as distance learning, is a form of digital learning in which learning is enhanced by technology and the participation of learners is not limited by geographical location, rigid schedules, or poor teachers' constructivism, etc. The activities in such models are generally flexible and student centred. There are several digital learning models, including online learning, e-learning, blended learning, open learning, and mobile learning. Most of these models overlap with one another, as they have closely related features and use similar structures and infrastructures (see Figure 1). Due to the limited infrastructure in Africa (such as poor Internet connections and unreliable power supply, among other things), the most practised model of digital learning in Africa, and in many other developing nations, is blended education or blended learning.

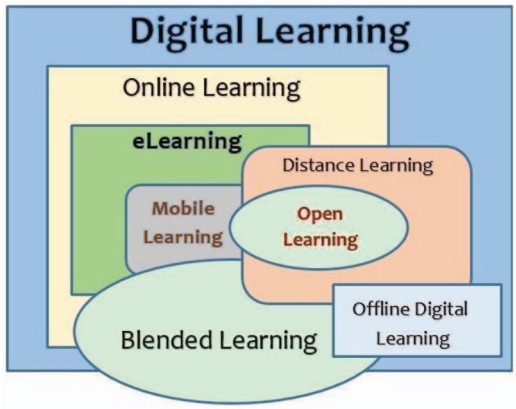


**Figure 1.** The convergence of different forms of digital learning.

Blended learning is a mixture of online teaching and face-to-face learning that allows limited physical contact between teachers and learners. This mode is already commonly used by tertiary institutions worldwide, mostly initiated as emergency open and distance learning (ODL) and as a short-term strategy to mitigate the challenges posed by the COVID-19 pandemic. With the success of the emergence of ODL, most educators have now agreed that personalised education, as practised in distance education, yields better learning outcomes – and technology has accelerated the process. The so-called 'flip classroom' model, where students absorb new materials to be studied on their own and as homework, but later use classroom (virtual room) time for discussion, has personalised the process of learning and proved to be efficient and effective [4].

For teaching and learning to be more effective and to maximise the potential of effective and personalised learning in distance education, the focus should be on how students are engaging with the teaching resources provided and the use of technology to drive their engagement and interactions. Likewise, the formats with which teachers design their resources, create assessment and receive feedback is crucial as education is an interactive (or two-way) process. To achieve this, instructional design is desirable for the design of the teaching and learning resources, together with the use of new and revolutionary technologies for interaction, engagement, and assessment [4].

## 3. FEATURES OF INSTRUCTIONAL DESIGN EDUCATION RESOURCES

The Commonwealth of Learning defines instructional design as a systematic approach to facilitating learning by identifying the purposes of the learning, especially learning objectives; developing the learning experiences necessary to achieve those purposes; evaluating the effectiveness of those learning experiences in achieving the purposes; and improving the learning experiences-teaching, in the light of evaluation, so as to better achieve the purposes [5]. Sometimes, the requirements of national regulatory bodies, if available, make it necessary for institutions embarking on distance education to have a long-term instructional plan,

curriculum including provisions for course development, the ability to undertake cost analysis, instructional materials (development and maintenance), methods of delivery, mechanisms for the assessment of teachers and learners performance, and mechanisms to evaluate the effectiveness of the programme. Without all these components in place, distance education cannot be implemented efficiently [6]. In addition, certain standards and rules should be put in place, such as: all courses must be designed with an understanding of the demographics of potential participants, learning objectives that are measurable by student learning outcomes, assessment activities that are aligned with these objectives, and instructional activities that are designed to bridge the gaps between the course objectives and assessments [6]. Furthermore, instructional designers need to work with faculty subject matter experts to ensure standards and the integrity of the course content, in that they are error-free, grammatically correct, and aligned with present industry practices.

Instructionally designed teaching and learning resources are designed, created, and analysed by applying instructional design models such as the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model, Bloom's Taxonomy, and Robert Gagne Nine Events of Instruction, among others. These teaching resources can be in different formats, such as a printable readable format (text-based) or multimedia (graphics, animations, and videos), and are made available through a learning management system (LMS) as courseware. Delivery methods may include the use of an LMS, a massive open online course (MOOC), a mobile learning platform, a web-based e-learning platform, or social media. Design challenges and considerations for low resource settings, such as offline access using mobile phones or other devices in the case of bandwidth limitation, are being adopted, facilitated by the advent of mobile platforms.

## 4. PRESENT AND EMERGING TECHNOLOGIES IN DISTANCE EDUCATION

Before COVID-19, distance education was struggling with low acceptance and low credibility, as well as some myths about its efficiency. However, COVID-19 underscored the important role that technology can play in education, especially distance education. While a substantial number of educational technology (EdTech) tools existed pre-COVID-19 (such as Edmodo, Socrative, Projeqt, Thinglink, Animoto, Khahoot, TED-Ed, cK-12, and ClassDojo), the pandemic accelerated the transition towards a more robust blended and technologically-oriented approach using EdTech tools. The pandemic served as a catalyst for a substantial increase in the number of EdTech tools, applications, and education platforms. Organisations with education goals, such as the United Nations Office on Drugs and Crime (Global e-learning), the United Nations Institute for Training and Research (iLearn and UMOJA), UNICEF (Agora), NUFFIC (e-VALUATE Project), have promoted and sponsored distance education as a viable way of enhancing the livelihoods of people and promoting peace.

The most prominent technologies used in distance education for content delivery and engaging learners, especially in synchronous learning, can be categorised as (but are not limited to): social networks, LMSs, web-based and e-learning platforms (web conferencing), mobile applications (video conferencing, m-learning), virtual laboratory environments and laboratories for simulations and virtual designs (3D modelling, virtual labs and simulations for lab-based courses, augmented reality, virtual reality,

computer-aided designs), and remote proctoring software. These technologies are described in some details in the following subsections.

### 4.1 Social Networks

Social networks have played a crucial role in distance education, especially during the lockdowns implemented to prevent the spread of COVID-19. When the lockdowns were imposed, most education institutions had limited or no infrastructure, no distance education policies, and no ICT policies in place to provide extensive and quality education to learners. Hence, most institutions turned to social networks such as WhatsApp, Google Classroom, Telegram, and Facebook to facilitate teaching and learning. Many learners also prefer social media platforms to any other forms of online learning, due to the limited resources required to access such platforms. A survey conducted on the use of social media for online learning [7, 8], using the modified unified theory of acceptance and use of technology (UTAUT) model to measure the acceptance of learners (both in distance education and traditional classrooms) of social networks for continuous education engagement and facilitation, found that 93.3% of 950 distance education students believed using social media increased their productivity. In addition to social media, other platforms such as blogs, wikis, and discussion boards have also had tremendous use in facilitating teaching-learning during the COVID-19 pandemic. All these platforms have raised the awareness and acceptance of digital learning as an alternative to traditional face-to-face education.

### 4.2 Learning Management Systems

While social networks and other related technologies provide an easy and inexpensive way of delivering content and engaging students, most of these platforms are not able to track learners' engagement. The learner-centred activities that can be performed on them are limited and, most of the time, learning performance cannot be tracked or analysed. Thus, a better alternative to social networks is a learning management system.

An LMS is a software that manages, delivers, tracks, and evaluates all users and activities, with flexible and powerful content delivery and assessment strategies via learning activities such as quizzes, assignments, workshops, chats, and web conferencing. Several types of LMS are used for digital learning, ranging from open source LMSs (such as Moodle, Chamilo, Caroline, Desire 2 Learn [D2L], Sakai, and Google Classroom) to premium ones (such as iSpring, Blackboard, and Canvas). E-learning delivery relies on the ability of the LMS to read, run, and generate data and reports on the use of learning content. In the absence of quality learning content, an LMS may not deliver optimum results, thus, the choice of which LMS to use is dependent on institutional needs and budget. For a good comparison of most popular LMSs, see Cavus and Zabadi [9] and Kraleva, Shabani, and Kralev [10]. Most LMS have rich features, are customisable, and support plugins for other functionalities that might not be readily available in the default provisions. With an LMS, all actors can be tracked, reviewed, and evaluated. These features contribute to the exposure of distance education, leading to the efficacy of the learning mode.

Apart from learning content, an LMS provides a massive repository of rich data about learners, learning interactions, behaviours, and competencies that are well suited to the data analytics process. The learning content delivered via most modern LMSs, or Sharable Content Object Reference Model (SCORM) enabled LMSs, are FAIR compliant, because they are findable by design and customisable, accessible with or without authentication, interoperable, and reusable using SCORM and application programming interface plus (API+) guidelines on other LMS platforms. However, the massive data generated by an LMS from interactions with the learning content are not FAIR compliant. One major goal of data science is to facilitate knowledge discovery by assisting humans and machines with the discovery of scientific data and associated algorithms and workflows. With the increased adoption of digital learning, there is a lot of data scattered throughout the various LMSs globally, hiding a massive amount of research information just waiting to be explored for data-driven decision making, especially by education regulators. Hence, there is a need to 'FAIRify' the education data generated by these LMSs, regionally, nationally, and globally.

### *4.3 Web-Based and Mobile Learning Platforms*

During the COVID-19 lockdowns, e-learning platforms kept popping up all over the Internet. Different stakeholders developed both web-based platforms and mobile applications, as a means of continuing disrupted academic sessions. While some of these platforms are financially motivated, there are also free ones, such as ones sponsored by international organisations like the United Nations, United Nations Educational, Scientific and Cultural Organization (UNESCO), UNICEF, Microsoft and other international non-governmental organisations and foundations, as well as those developed by free and open-source communities. Typical examples include platforms like Agora and Learning Passport. While most of these platforms are not as robust as an LMS, and are prone to integrity flaws (cheating and malpractices), especially during assessments, features such as browser lock and remote proctoring can be used to mitigate these challenges.

There has also been a tremendous increase in webinars, e-workshops, and e-conferences. Some technologies have become more popular than they were before the lockdown, such as Zoom, which nearly everyone with an Internet connection used at one time or another during 2020. Popular applications for mobile learning include Coursera, SoloLearn, DataCamp, Simplilearn, and OppiaMobile. Some institutions have even designed their own customised applications for academic purposes.

### *4.4 Virtual Laboratory Environments*

Research and laboratory practical experiments can now be done via simulations, overcoming constraints such as cost and affordability, the hazards of research, and the availability of the physical elements needed, as well as location and logistical constraints. Such activities can be undertaken by embedding artificial intelligence (AI) technologies such as virtual labs, virtual reality, augmented reality, and 3D modelling into the learning space. These technologies are now being used to create virtual environments and elements that can be employed in such experiments and research. Some examples of these tools are PhET, Virtual

Laboratory, Molecular Workbench, Praxilabs, and Chemical Reaction Simulator, which are used as alternatives to practical activities in physics, chemistry and other subjects.

### *4.5 Proctored Examinations Software*

Computer-based test (CBT) assessments have been done for years in distance education, via quizzes on LMSs or other platforms. These quizzes are either monitored by people or not at all, except for the internal anti-cheating criteria like question and option shuffling. However, with new technologies, such as browser lock, plane detection (background monitoring via video and image feeds), facial recognition, posture, and eye movement detection, and so forth, CBT quizzes and examinations can now be proctored remotely, either via an online human proctor or a live AI proctoring software. Suspicious behaviour and cheating during assessment can be tracked and triggered. Typical examples include ExamOnline, ProctorU, Honorlock, Examus AI Proctoring, Disamina, and ProctorLive AI.

### *4.6 Online Viva or Online Capstone Projects*

Before COVID-19, institutional events such as research defences, graduations, capstone project defences, matriculations, inaugurations, and so forth were done physically in auditoriums and halls. However, the restrictions imposed by most governments due to COVID-19 have required administrators to conduct events that are crucial to the curricula and progress of the institution virtually, as the academic calendar runs out. As such, e-graduations are done using avatars to represent the graduates, the same for e-matriculations and e-inaugurations [11]. Other events and documents such as e-meetings, e-memos, and e-approvals are being used for various purposes by most distance education actors.

### *4.7 Webinars and E-Conferences*

Another development spawned by COVID-19 is the proliferation of webinars, e-conferences, and other forms of virtual workshops. The increase in the use of such tools can be explained by the low budget required to organise and implement such events, as well as their ability to overcome the logistical problems posed by physical events. Now, webinars are popular and commonly used by institutions, groups and individuals. These events have minimised travelling costs, contributed to the body of knowledge, created opportunities, raised awareness, and conveyed beneficial information to the participants.

## 5. POTENTIAL OF DISTANCE EDUCATION

With distance education ushering in a new era of education pedagogy, new methods of teaching, learning, assessment, and review have been introduced. New, and emerging technologies, especially AI-based systems, have increased the potential of distance education. The applications for distance education are unlimited, ranging from academic training purposes to securing peace and resolving conflicts. Some of the major use cases include: skilling, up-skilling and reskilling [12]; healthcare [13]; research (alternatives

to practical, computer-aided design [CAD], simulation, AI); customised training for certain specialisations (e.g., data stewardship, company training for newest recruits); and special purpose teaching (e.g., on topics such as peace building and conflict resolution, mental and psychological wellbeing, gender equity, human rights awareness and promotion, disaster recovery management and climate control, and business, financial and wealth management). These applications are discussed in the following sub-sections.

### 5.1 Skilling, Up-Skilling and Reskilling

The proliferation of online education platforms is on the rise, with nearly all tertiary institutions worldwide providing, or preparing to provide, student-centred distance education programmes. It is not only education institutions that are tapping into this field, but also organisations and individuals seeking to take advantage of the flexibility and lack of geographical limitations provided by distance education. There are now many MOOCs, LMSs, education and teaching applications, video conferencing apps, and remote proctoring software available. Some of the popular MOOCs are Coursera, Udemy, EDX, and Khan Academy. All of these platforms specialise in the skilling, reskilling and upskilling of participants on certain subjects and specialisations. These platforms are being used by tertiary institutions such as Harvard, Massachusetts Institute of Technology, Ladoke Akintola University of Technology, Kampala International University, and many others practising distance education. Likewise, some of the popular LMSs are Moodle, iSpring, Blackboard, and Totara Learn. Most institutions practising distance education use one or more LMS, or build their own from scratch, to manage their education activities.

### 5.2 Research and Simulations

In distance education, the approach to simulations and research is not the same as in face-to-face learning. In tertiary institutions practising conventional or traditional face-to-face teaching, research is done in physical research laboratories using physical laboratory equipment to perform the experiments. However, in distance education, alternatives to these practical experiments are performed using virtual laboratories and simulation software. Virtual labs are replicas of real wet labs, available to the user through a desktop computer or a virtual reality headset. Virtual laboratories allow science, technology, engineering, and mathematics (STEM) students to experiment in million-dollar labs at a fraction of the cost of a wet laboratory [14]. Courses that require hands-on practice with live monitoring by teachers or technicians, such as courses that cover chemistry and physics and other laboratory-based courses, use these virtual labs for their experiments. Other forms of research in the virtual environment are 3D modelling, computer-aided design (CAD) and use of open-source simulation software (such as OpenModelica, OpenSimulator, Logisim, Opensurgsim, Opensim) or premium software (such as MATLAB, LabView, Simulink).

### 5.3 Customised Special Training: Data Stewardship

Instructional design not only applies to academia. Nowadays, companies, non-governmental organisations, and individuals all use instructional design in their activities. In the same vein, distance education can be

used to create specialised training and guides beyond academia. Career paths and boot camps are now designed using specific curricula tailored towards achieving a specific purpose. A typical example is VODAN data stewardship training. This training is designed to produce data stewards and provide them with much needed technical skills on FAIR Guidelines, FAIR data regulatory frameworks, the installation of FAIR Data Points, and other related topics needed by data stewards to carry out their duties.

## 6. NEW POSSIBILITIES FOR DISTANCE LEARNING

New technologies have brought about so many changes to the education system that distance education is here to stay and will improve with time. Within the limited time that the world's attention has been drawn to distance education, out of necessity due to the COVID-19 pandemic, great potential has been identified. While some of this potential is already being realised (such as the ability of learners to learn anywhere and anytime, at their own convenience), there are still some benefits that are only beginning to manifest or will manifest in the future.

Some of the potential benefits of distance education are:

- **Desegregation of teaching and learning contents:** With distance education, all learners worldwide can be educated using universal teaching materials. This will abolish, or at least reduce, the dominance of certain institutions over others, as learners will have access to the best teachers in the world. In the same vein, this will allow the quick adoption of new technologies, as knowledge is shared among all partners.
- **Improving the social economic resilience of students from marginalised communities:** At times, certain events or circumstances can cause learners to become disconnected or marginalised. Typical examples are the COVID-19 pandemic, natural disasters, and conflict or war. In such scenarios, victim's lives are disrupted affecting their education, lifestyles, and social and economic situation. Distance education allows the continuous engagement of learners, as well as continuous skilling, not only for education purposes, but also from a socio-economic perspective. With distance education, learners are kept busy, distracting them from their troubles, with the possibility of becoming employed or self-employed and earning income after successful completion of their course, as well as providing them with a platform for emotional support. Figure 2 explains how a distance learning intervention, the adoption of technological innovation (distance learning), and the level of disruption of social economic system and trauma (due to COVID-19 and war) affects the social economic resilience of vulnerable students from disadvantaged communities.

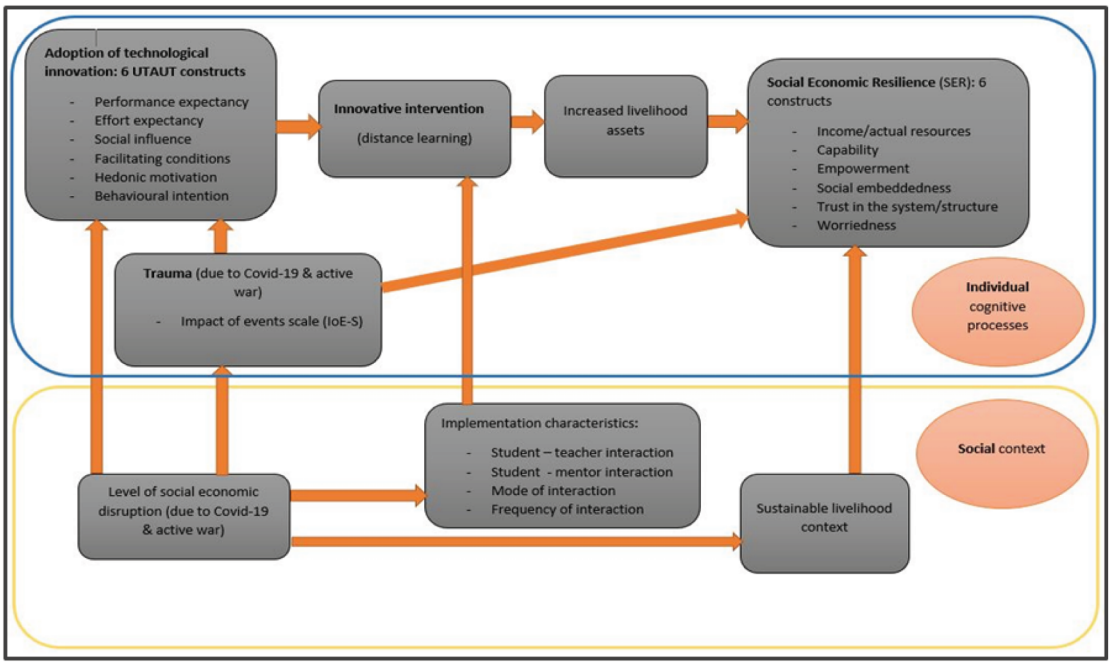


**Figure 2.** Conceptual framework to measure social-economic resilience.

- **Improved assimilability via contextualisation:** Most textbooks on shelves and in bookstores were created for learners within a specific locality, with consideration of that context only. With distance education, the learning materials need to be contextualised and personalised to consider the local variables in the learners' environment. In addition, the policies, laws, and technologies available, as well as the recommendations of the regulatory bodies, need to be considered during the instructional design of teaching resources.
- **Customised training for learners:** While it is true that the advent of AI-related technologies will result in a lot of job loss, it will also create new jobs and roles, and require new skill sets. There will soon be jobs that have no job title yet. Distance education will provide, and has been providing, a platform for learners interested in acquiring new skills, beyond current academia curricula. A typical example is FAIR data stewardship in the DISH project, as well as data science boot camps and other career-specific boot camps available via distance education technologies.
- **FAIRification of education data for analytics:** Performance monitoring is used to reveal whether or not projects are on track and expected results are being achieved. Hence, the collection of performance data is critical to distance education projects to evaluate activities, for accountability, and to assess learners' outcomes. During and after the COVID-19 lockdowns, to evaluate the performance and efficiency of distance education schemes, online surveys and questionnaires were created by researchers to determine the efficacy of projects. All these evaluations generated a lot of

data, which can be used to identify flaws and improve distance education. Some mobile applications also synchronise such data periodically to enable the monitoring of students' progress.

- **Increased demand for skills that enhance employability:** Institutional certificates are becoming less valued, as traditional curricula, especially in the developing world, are not always up to industry standards. As such, there is increased demand for skills that enhance employability, such as soft skills, creative skills, and critical thinking. Industries are seeking workers whom they do not have to train from scratch. All these skills can be obtained via distance education schemes.
- **Lifelong learning:** We live in a time of great technological change that is unprecedented in its pace, scope, and depth of impact. Given the rate at which technology is developing – curricula and technical know-how can become obsolete in a few months or years [3] – it is challenging for academia to keep up with the changes. Thus, what someone learns in school might no longer be useful when he or she enters the labour market. This has precipitated the need for lifelong learning, where individuals need to upskill and re-skill if they want to remain relevant, which is achievable via distance education.

## 7. NUFFIC DISH: DISTANCE EDUCATION PROJECT CASE STUDY

### *7.1 Project Overview*

NUFFIC DISH is a distance education project that encompasses most of the use cases and potential discussed in this article. The project aims at strengthening the employment opportunities for youth in vulnerable and marginalised communities through three-month tailored e-learning/distance learning training courses. The project is also increasing the critical mass of domain experts to adapt and migrate learning content from analogue to digital format, thereby improving the institutional capacity of partner institutions with the added advantage of contributing to regional peace and stability. The project is funded by the Dutch Ministry of Foreign Affairs under the Orange Knowledge programme, in conjunction with 12 partners from different East African countries.

DISH is a multi-language e-learning platform developed to provide youth and women in the Horn of Africa with access to employment skills training. One of the objectives of DISH is to increase enrolment in certificate education in order to improve employment possibilities, especially in relation to remote work involving digital technology, primary school teaching and health related jobs. Since the beginning of the COVID-19 pandemic, youth and women have faced increased challenges in finding employment, while employers have struggled to employ people with the necessary skills in fast-growing sectors of the labour market. Through DISH, online short certificate courses of three months are created and made available. The courses increase the employability of youth and women because they are linked to key emerging sectors, thereby contributing to stability, peace and resilience. The DISH courses bridge the gap between the skill sets of job seekers and those required by the market, focusing on low-threshold e-learning courses, using both online and offline digital learning modes for a variety of devices and settings. The project is targeted towards youth in vulnerable and marginalised communities, such as refugees, women, internally displaced people, disabled persons and other disadvantaged groups, among others, and aims to equip them

with various skills, depending on the course undertaken, in order to enable them to secure and sustain employment. More details on the project can be found on the project platform.

### *7.2 Structure of the Project*

The project contains 11-courses each offered over a period of 12 weeks. The participants are allowed to pick appropriate courses, as they see fit, according to their interests and specialisations. Figure 3 shows the 11 courses offered by the project.


**Figure 3.** DISH courses.

Upon registration, learners are issued with study materials and given access to the project's LMS. The instructional design resources are available in readable and printable formats, as videos, and as courseware on the LMS. Several activities have been designed to complement the learning resources and equip learners with the skills needed to perform in whatever job they are recruited for. These activities include forum discussions, workshops, real time interactions, video conferencing, and live chats, etc. Student support is provided in the form of a help desk, counsellors, information officers and so forth.

Given that the target learners are mainly refugees and displaced persons from the Tigray region (Ethiopia), Garowe and Mogadishu (Somalia), Kassala and Khartoum (Sudan), and Wau and Juba (South Sudan), every participant is required to first enrol into two short modules: 'Peace Building and Conflict Resolution' and 'Trauma and Mental Health'. These modules are designed to help the participants to cope with the trauma they may have experienced in their home country or elsewhere.. Participants' mental wellbeing is key to the successful completion of the courses and in preparing them to face their future with hope and positive expectations.

Quite a number of lessons were learnt during the preparation, design and implementation of the project, including the fact that there is a high level of interest in distance education for capacity building for personal and societal development among vulnerable persons. Difficulties have also been experienced, such as

infrastructure deficits, poor Internet connectivity, the unavailability of experts, and the shutdown of communication, both physically and virtually. A good example is the Tigray region in Ethiopia, one of the key target areas of the project, which was shut down completely (including the Internet and other forms of communication) due to regional conflict in 2020. Internet services are also weak in Sudan and there have been difficulties in procuring equipment and services by partners due to movement restrictions in response to COVID-19. Limits on the financial transactions of organisations used to procure goods and services and the absence of comprehensive policies on distance education have also impacted on the project.

### *7.3 Challenges and Constraints of Distance Education*

Exploring the sudden shift from classroom learning to e-learning in the context of the NUFFIC DISH project has shown that there are many challenges, not just for the teachers and education institutions, but also for students and parents/guardians. Balancing the needs of all has been quite a mammoth task. Some institutions have been struggling to get on top of this new mode of learning, including conducting live lectures via third-party apps and uploading study materials in appropriate formats, all the while dealing with differing degrees of poor Internet connectivity. Some of the constraints on distance education, for teachers and learners, are listed below.

For teachers:

- Limited infrastructure, e.g., poor Internet connectivity, irregular power supply
- Poor technical implementation and lack of technical know-how
- Lack of policy and regulatory frameworks
- Incompetence of teachers in demonstrating and facilitating knowledge
- Lack of experience and/or training with instructional technologies
- Poor time management skills
- Poor administrative oversight
- Poor financial remuneration

For learners:

- Limited infrastructure, e.g., poor Internet connectivity, irregular power supply
- Difficulty in choosing a quality education programme
- Reluctance on the part of employers to accept distance training
- Poor development of oral and social interactions skills
- Difficulties in learning technically demanding material
- Difficulty staying motivated due to isolation
- Difficulty interacting with peers and teachers
- Poor feedback from teachers on performance
- Poor time management skills
- Lack of support from friends and family

### 7.4 Reaching the Marginalised Communities with Low Connectivity

With the aforementioned constraints due to where the participants of the DISH project are located, and the need to reach learners despite the limited available constraints, the project set up physical centres in seven places across the targeted localities. They project also catered for the equipment and other needs of participants, including:

- Tablets/laptops
- Internet
- Multimedia studio equipment

The approach employed by the project for teaching-learning is the blended learning approach, where the learners partake in both online and physical classes. For online learning, the learning resources were made available in hard copies – printed documents for readable modules and Interactive DVDs for video-based resources. Likewise, a mobile application was developed to allow learners to download the resources on their tablets and use them offline. At the centre, they can charge their tablets and use the Internet to update their mobile applications, synchronise with the latest activities in their courses, and upload their assessments. In this way, the learners are able to learn both synchronously and asynchronously.

## 8. ENHANCING DISTANCE EDUCATION WITH FAIR GUIDELINES USING DATA STEWARDSHIP

Data stewardship and FAIR Guidelines have important and rapidly evolving roles to play in the future in many parts of our digital society, including the research and education sectors [15]. FAIR's data stewardship programme speaks directly to academic institutions about the responsibilities involved in data curation and access. Just as the physical assets of academic institutions should be managed effectively to provide the best learning and working environments, so too should the data available to the institution about programmes, services, finances, operations, and facilities be managed to improve understanding, increase efficiency and effectiveness, inform decisions, and support change [16]. In today's digital world, data stewards are regarded as one of the key personnel for data governance and management [17]. Although it may be possible to have data stewards, and even a data stewardship programme, without data governance in place, true data governance cannot exist without data stewards [16].

Backscheider et al. [16] identify the following types of data as areas in which data stewards may be needed to create, manage and analyse data in distance education:

- **Student data:** Data on admissions, transcripts, housing, student heath, athletic activities, bursaries, financial aid, learning analytics, distance education, demographic information (age, locations, work types, etc.)
- **Administrative data:** Data on institutional finances (budgets, investments, financial transactions, statements, and balances, etc.), institutional research and assessment, human resources, facilities, IT, legal/general counsel, safety and security

- **Academic data:** Data on professional and academic decisions regarding faculty affairs, academic administration, library services, data from provost office, etc.
- **Alumni data:** Data on alumni, alumni relations, and development
- **Research data:** Data associated with research, data generated by research

Wildgaard et al. [15] identify the following as areas in which the potential of distance education can be enhanced by FAIR data policies and analytic results from data stewards:

- **Identify topics that can be taught using distance education:** Education is much more than going to school or college – it goes beyond academic skilling, reskilling and upskilling. There are global problems that can be solved, or at least mitigated, by educating people. Martin Luther King said, "Nothing in all the world is more dangerous than sincere ignorance and conscientious stupidity". Topics such as poverty, trauma, poor health, mental wellbeing, disaster management, financial literacy, investment opportunities, arts, and creativity are aspects of life that can be taught to people using distance education technologies, without the limitations of a physical academic institution. However, data is needed to identify these topics, the resources needed, the management and operation approach to be taken, and the targeted demography, all which need data stewardship, which FAIR policies can enhance.
- **Improved instruction:** Instruction in this context refers to the teaching and learning resources. Information about a student's previous education experiences and any special needs that the student might have can help teachers and counsellors to design and deliver appropriate instruction in education programmes. FAIR can help to identify any gaps in the curriculum, learning objectives, and skills that are outdated or might not be aligned with current industry standards.
- **Efficient operations and decision making:** Institutions need data to ensure the efficiency of day-to-day functions, such as attendance records, meeting individual students' special needs, handling individual students' health problems, and so forth. The same is true for staff, alumni, physical assets, and other important areas of an academic institution.
- **Accountability and better management practices:** Schools, districts, and state education agencies use data about students for planning and scheduling education programmes and for distributing resources. They also use data about students and individual students' progress to provide information about students' accomplishments and the effectiveness of schools and specific education programmes.
- **Research and evaluation:** Academic institutions, government, foundations, and education agencies use data about students and their progress to analyse programme effectiveness, determine the success of student subgroups and changes in achievement over time in order to identify effective instructional strategies and decide on the best approach to utilising resources like grants, scholarships, and research sponsorship. Similarly, as research papers, theses, dissertations, and data products are key outcomes of scientific experiments, simulations and studies, data management and stewardship is needed to ensure that these reports can be easily found, accessed, and reused and are interoperable considering new theories and hypothesis, which why the FAIR Guidelines were promulgated [16].

Enabling data to be findable, accessible, interoperable, and reusable is believed to strengthen data sharing, reduce the duplication of efforts, and move from heterogeneous unconnected data silos towards the harmonisation of data [18].

## 9. CONCLUSION AND RECOMMENDATIONS

Catalysed by the COVID-19 pandemic, the future of distance education looks promising. ICT-enabled technologies inherent in distance education have mitigated some of the challenges involved by providing a form of engagement for learners and teachers, giving them the opportunity to acquire new skills, up-skill, and reskill. In the process, COVID-19 has changed education, possibly forever, including by:

- Changing education pedagogy
- Increasing the use and acceptance of e-learning by individuals, institutions, and governments
- Catalysing the proliferation of e-learning platforms, applications, education resources and education technology start-up companies
- Opening up the possibility of a hybrid of e-learning and traditional classroom learning after the pandemic
- Promoting flexible learning, self-learning, and lifelong learning
- Focusing on employability and creativity skills
- Promoting flexibility in the mode of learning with limited restrictions on student engagement
- Closing the digital divide and promoting digital literacy
- Reducing travel and accommodation costs through online conference participation

While there may be initial constraints on the successful deployment of digital learning, especially in the developing world, there will be increased enrolment of learners, as new players, technologies, policies, and practices are incorporated nationally and regionally. Thus, only the institutions, organisations, and platforms that can harness the massive amount of data generated from all types of digital learning will be able to adapt to the changing times and develop solutions to overcome the constraints and challenges in order to meet the evolving needs of learners. Traditional face-to-face learning, coupled with the COVID-19 pandemic, created a constricted environment for learners. Digital learning provides opportunities for more engaging and immersive content with the use of interactive videos and voice interfaces, facilitated by advanced technologies such as AI, virtual reality, augmented reality, and mixed reality.

While the use of the FAIR Guidelines for research and health data management has advanced, its use in digital education platforms is only at the very beginning. Following the COVID-19 pandemic, the obstacles to digital learning in Africa have decreased and more tools have become available, which has extended the feasibility of digital learning, including in remote settings. With the expansion of digital learning, a need has emerged for the FAIR Guidelines to be applied to distance learning, to optimise data management and explore its use for digital education. Going forward, FAIR data stewardship will be vital to digital learning platforms.

This article also looked at NUFFIC DISH, a project that aims to expand digital learning for vulnerable students, providing them with a pathway into the education system and enhancing their employment opportunities. One of the courses under this project is FAIR data stewardship. As the FAIR Internet of Data and Services is realised, FAIR data stewardship will become a new area for learning and employment. Both distance learning and the inclusion of innovations, such as FAIR data management, hold promise for education in Africa and should be exploited. The devastating COVID-19 pandemic may have one positive outcome – the realisation of distance learning and digital innovation for Africa.

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## CONFLICT OF INTEREST

All of the authors declare that they have no competing interests.

## ETHICS STATEMENT

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Uganda National Council for Science and Technology, Reference IS18ES, July 23, 2019–July 23, 2023.

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