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Developing Models for African Tertiary Education's Response to COVID-19 Pandemic and Other Emergencies: Adapting Existing Systems, Infrastructure and Practices for Online Teaching

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Authors' contributions

This work was carried out in collaboration among all authors. Author JO initiated and coordinated the commentary. Author JO also wrote Section 2. Author MA wrote Section 3. Author KA wrote Section 4. Authors CM and EM Wrote Section 5. Author AB wrote Section 1 and served as project advisor. All authors contributed to the abstract and summary; read and approved the final manuscript.

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ABSTRACT

It is very important to address the need to adapt the existing structure to meet the demands of the emergency situation that has been placed on tertiary institutions globally and with specific emphasis on the African institutions. In the face of the emergency situations such as the one that has been created by the global pandemic covid-19; it is impractical to start building *de novo* systems to address this challenge. Hence, the practical and logical response to these will simply be to reposition the existing systems in ways that they can be used to achieve optimal results. This

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paper is an attempt to provide guidance and models for African tertiary institutions in the ongoing attempts to achieve such adaptations with optimum results. One of the realities and effects of the covid-19 is implementation of the social distancing policy and practices in many countries of the world, consequently many schools have either started running virtually or planning to do the same. What this would imply for many African institutions whose curricula are conventional and significantly premised on learning theories that make use of contact instructional methods such as lectures, seminars, group discussions and demonstrations among others would be confronted with the need to transition to the online virtual environment which has a different approach to teaching and learning. There will also be a need to align the new methods of teaching to the learning theories that support the curriculum. Since it would be impractical to develop new curricula immediately, the new methods would rather have to be aligned with the existing curricula. This has to be most properly done as there is the tendency to create misalignment between curricular philosophies and implementation and this would most likely influence the learning and program outcomes. Adaptation is therefore very crucial. Furthermore, while the current scenario has been caused by the covid-19 this guide, the currently proposed models and methods might be useful and applicable in other emergency situations. In order to achieve effective adaptation, we believe that four major factors should be given critical consideration. These include: [1]. Pedagogies and Resources [2]. Instructional Design Adaptation for Online Teaching [3]. Infrastructure: LMS, ICT, System and Connectivity [4]. Implementation and sustainability. This article provides guidance and models for proper adaptations in light of these.

Keywords: Education; online; Africa; COVID-19; pedagogy; teaching.

1. BACKGROUND

The COVID-19 pandemic hit the continent when relatively few African tertiary institutions were developing interest in innovative curricula and educational systems that provided for adequate integration of e-learning. The COVID-19 virus, a novel virus with its original name as severe acute respiratory syndrome coronavirus-2 or SARS-CoV-2 was first reported in Wuhan China in late 2019 [1]. By the first quarter of 2020, it had caused many African countries to start putting in place lockdown measures, which included the closure of schools as well. Few institutions had started investing in the needed infrastructure to implement basic e-learning including sufficient internet bandwidth, provision of access devices such as laptops to students and faculty, introduction of Learning Management Systems (LMS) to mention a few. Faculty and students also needed to be trained in the basics of developing and accessing e-learning courses and modules.

However, when the pandemic resulted in massive shut down across the continent, institutions were abruptly faced with the only option of staying relevant to their students, immersing themselves into virtual learning, albeit, most curricula were traditional and delivery methods were generally by contact or didactic. There were also academic programs that were very dependent on the face to face modality such as clinical medicine and laboratory-based programs. It would be prudent to mention that some institutions gradually evolved and took the challenge. However, this grafting of an enforced new method of delivery over a traditional curricular philosophy and structure could produce undesirable outcomes in the nearest future, post-COVID- 19. It is our duty to help the continent, and by extension, the world.

2. LEARNING THEORIES AND THEIR INFLUENCES ON CURRICULUM, PEDAGOGIES AND RESOURCES

It is important to note that the curriculum provides a standard template for instruction. While the curriculum provides this template, its philosophy is typically premised on certain learning theories. The main learning theories about a curriculum expectedly influence the methods of instruction. Expectedly, the main types of instruction will determine the required skills that each teacher should have in order to effectively deliver sessions to fulfill the objectives of the curriculum. What is clear from this illustration is that an emergency-mode abrupt change in methods of instruction could cause misalignment with the template- the curriculum, except the institutional system makes a conscientious effort and strategic planning during the process, particularly from the physical to the virtual. The lesson to learn from this illustration is

that the curriculum should be flexible enough to accommodate a wide range of instructional methods and utilize diverse teaching skills in a learner-centered approach. However, the typical traditional curriculum that is available in many institutions might be relatively rigid, and in certain instances; problems might arise from lack of congruence should changes be made without adequate plans and strategies. This part addresses leaning theories so as to help with choices and decisions when attempting to adopt eLearning systems. Many currently used curricula are built around popular learning theories which include behaviorism, cognitivism and constructivism [2]. These theories are briefly considered in the following section:

2.1 Behaviorism

Behaviorism and its principles can still be found in most educational settings even though it is the oldest of the theories discussed here. Behaviorism posits that learning is basically a measurable change in behavior that can be achieved by conditioning the environment. Classical behaviorism posits that the learner simply responds to the environment such as in the case of Pavlov's dog in the classical experiment. A simple example of this is when a teacher smiles at a student who has provided a correct answer to a problem. This can help to explain why many learning methods use rewarding and punitive feedbacks to encourage and facilitate learning in specific directions. The basic shortcoming of behaviorism is that it maintains that the environment facilitates learning while the learner is passive in the process [3,4].

2.2 Cognitivism

Cognitive learning theory uses the information processing model of the human mind to explain learning. For example, one might consider it that the human mind has sensory memory, working memory and long-term memory. Sensory memory can be thought of as the attention of the mind on a particular subject, working memory is when the mind begins to process what it has seen and long-term memory is when this process has led to information being stored and used at a later date. Working with this model of learning, curriculum developers can focus on aspects of instruction that can inhibit or enhance learning. If we consider that learners have long-term memory, and therefore prior knowledge, we can use this information to connect instruction to prior knowledge [5,6,7].

2.3 Constructivism

While behaviorist and cognitivist learning theories attempt to structure learning environments to enhance student learning, in constructivist theory context, the learner is actively engaged in organizing the information found in their environment. We can find many current instructional practices based on constructivist approaches. For example in flipped classrooms and blended learning environments the responsibility for much of the learning is placed on the student. Instead of an instructor standing in front of a classroom of students, students are directly engaged in readings where they create their own knowledge, to a degree of course [8].

2.4 Connectivism

Connectivism is a relatively new or emerging learning theory for the digital age [9,10] that is also somewhat controversial not because it is not applicable but because certain schools of thought have considered it as a method of learning rather than a theory. Connectivism is primarily attributed to Siemens [11,12]. In this context, it is the most modern learning theory that critically values human connections [including virtual], integration of technology and explains its extensive integration into institutional learning systems. In the current scenario, it might provide an explanation for basis as well as the mechanisms that might be involved in the process. This theory comes to mind as it becomes apparent that switching traditional curriculum abruptly into an online mode will require adequate connections of teachers, learners and non-human components over networks and the integration of non-human components. It might be required to use non-human elements to achieve learning directly or to serve as intermediate. This one explains why traditional curricula might not recognize this theory. It might be important to emphasize and acknowledge its significance in the currently unfolding scenario. This also implies that institutional systems need to employ evidence-based methods in the institutions' attempt to extensively deploy technology more than ever before in their attempt to transition into a virtual learning environment from the physical.

If we are to look for an ideal instructional theory from on which to build or create a curriculum, it would be wise to consider that there is something that can be learned from all four of these

theories. For example, behaviorism stresses the importance of assessment, cognitivism stresses the importance of making documents understandable, constructivism focuses instruction on learner based activities and connectivism stresses the importance of networked learning.

The Table 1 illustrates how each learning theory can help in the development of a useful model.

2.5 Other Useful Elements

Of course, there are other theories to consider when building a model for e-Learning. The following theories consider factors beyond the scope of the initial four learning theories. For example, confidence in ability and the ability to self reflect are critical to the success of students. Without these characteristics, many students can have difficulty with learning, for examples by having a difficult time completing assignments.

- Bandura's social cognitive theory [13]: Bandura stated that behavioural, environmental and personal factors interplay during learning and determine the outcome. The lesson from this theory is that a well-conditioned environment [physical or virtual], well predicted behaviours of the learner and the personal factors [age, level and situations] should be given adequate considerations [14].
- Schön's Reflective Practice: This theory was developed by Dewey and Schon; it involves a form of systematic and critical reflection over experiences in a way that the learner can construct internalised meanings and develop new or original solutions or solution-oriented actions [15].
- The Kolb's Experiential Learning and the Learning Cycle: Kolb posited that a complete circle of learning would have four major aspects: experience, observation, reflection and action or experimentation. It is also important to note that different learners 'major' in various domains. This implies that generally, instructional design and execution of learning or teaching plans should consider all the series: [i] to ensure that a learner completes the circle [ii] to ensure that each learner's domain of preference is considered [16].
- Knowles' Adult Learning Theory: Malcolm Knowles coined the term andragogy for the art and science of adult learning [17]. in place of pedagogy, which is presumably premised on a child's learning art and since. In summary, adult learners are more effective as self-directed, purpose driven, orientated and motivated learners. If given resources and opportunities, the adult learner would be relatively more effective.
- Single, double and triple learning Loops by Argys: In learning, the single loop is focused on providing basic answers to questions or solutions to problems; the double and triple loop elaborates learning to explain 'why'. The benefit of this is that it would greatly help the learner to adapt the learned lessons to various contexts [18].

It is important to note that there is no point trying to single out each method in order to develop specific instructional methods. The attempt being made here is to ensure that the right plans and strategies are given considerations when transitioning the institution from the traditional instructional method to the virtual environment. It will be helpful to give critical consideration to a collection of relevant learning methods during planning, designing and implementation. The need considers these learning theories needs to be emphasised so that the transition that is required to achieve optimal learning experience in the online environment in this particular context would give consideration to the pedagogy. The pedagogy has to be student-centered, even when it is instructor-facilitated. The next section provides insight into how to achieve this.

3. INSTRUCTIONAL DESIGN ADAPTATION FOR ONLINE TEACHING: MODELS AND BEST PRACTICES

What the learning theories and divergent practices provide curriculum and e-Learning developers are the tools necessary to develop thoughtful and engaging instruction. These theories provide basis, principles and tools necessary to understand the development process and make decisions in the development of curriculum that are based in theories and instructional research. Instructional design involves the systematic design of learning instruction based on certain theories and principles.

3.1 Instructional Design

Instructional design can be thought of as a way to organize all the theories and tools mentioned

above in a thoughtful and organizationally effective manner. It is important to realize that most of the work done to create an eLearning course is done outside of the learning management system [LMS]- before materials or resources are put unto LMS. Historically, the genesis of instructional design occurred during the World War II when the United States military needed to train millions of soldiers rapidly. Just like today, with the coronavirus, institutions of higher education need tools to help them adapt to the rapid changes this virus has brought. The most well-known instructional design model is the ADDIE Model [20,21]. The acronyms for ADDIE stand for each of the stages in the development of a course: Analysis, design, develop, implement and evaluate.

3.1.1 Analysis

During the analysis phase of instructional development the course developer analyses the learners, the objectives and the overall purpose of the course. It is during this phase that a picture of the course begins to form. During this phase it is important to answer the who, what, when, where and how of the course to be developed (Who is being taught, what are they learning, when will it need to be developed and how will it be developed?)

Table 1. Learning theory, learning principles, approaches and examples

Theory	What is Learning	Approaches	Examples
Behaviorism	Response to stimuli	Task based learning	Use of flash cards; reproducing a simulated activity
Cognitivism	Emphasis placed on existing mental structure	Clear objectives and problem solving	Ask students to justify their thinking
Constructivism	Engaging with environment	Social engagement	Students work on group project
Connectivism	Learning occurs through non-linear associations	Use of diverse learning sources	Students are required to use 12 sources when writing a paper

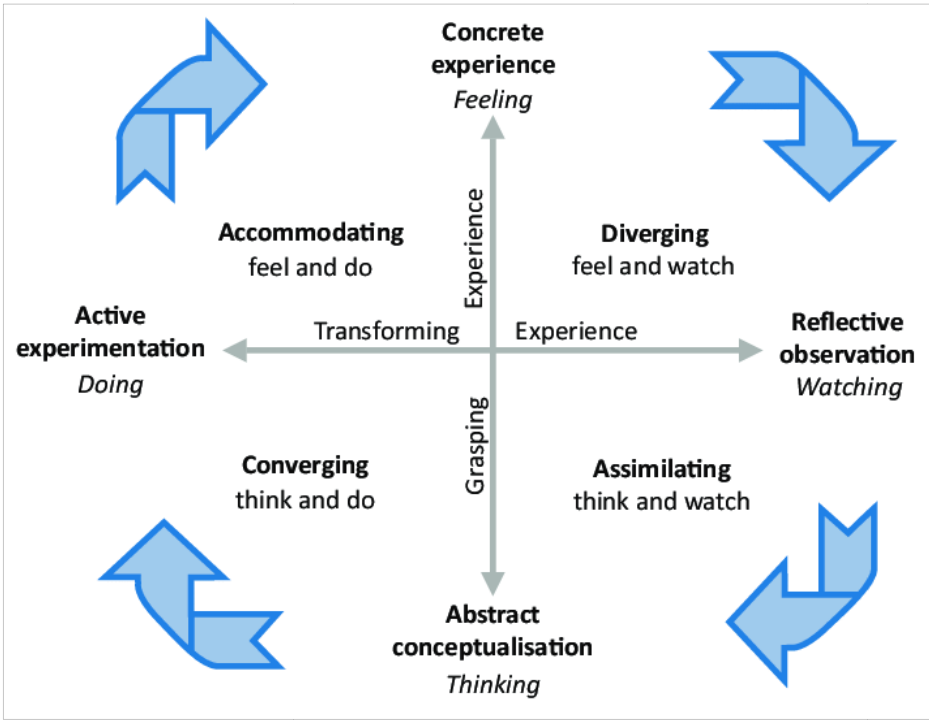

Fig. 1. The experiential learning cycle [19]

3.1.2 Design

It is during this phase that the designers of the course use the main objectives of the course to begin to design all the critical elements of a course, such as: Lectures, readings, assignments, assessments and so on. During this phase much of the work created can be placed into an organizational structure.

3.1.3 Development

During the development phase all the critical elements are being put into place. During this phase the instruction is tested.

3.1.4 Implement

During the implementation phase the curriculum is placed into its final form, be that a book, LMS or another approach. All stakeholders involved will be given access to the instruction that has been created.

3.1.5 Evaluate

A formative evaluation takes place throughout the development of the curriculum. The developer may have course evaluators looking at the curriculum throughout the different stages of development.

Learning theories can provide curriculum developers with a context from which to develop their courses. For example, to develop a course that taught the capitals of world nations, a teacher would probably use a simple behaviorist approach such as flash cards. However, if the objective of the course was to instill a sense of understanding what it was like to live in another country, a connectivist approach could be in order. The organizational structure of instructional design in combination with theories of learning can help to begin to formulate a useful model as we transition from in class to online teaching and learning. In order to understand how these theories and models can work together let us use an example from the beginning until the end of the process.

3.1.6 The development of our model: A way to adapt to an online learning system

The model we are building will be an attempt to take elements from the theories and the designs that we have discussed above and use them to create an efficient, rapid development approach.

3.1.6.1 Step one: Determine objectives and link to assignments

Every curriculum development begins with determining the goals and objectives of learning. This objective must be well written in order to communicate with the students exactly what it is they will be learning in a particular lesson. The objective also helps the course designer to determine what types of assignments and assessments to place into the course. It is during this phase that the designer connects a specific learning theory to the content that is being developed. The Bloom's Taxonomy can be helpful here; it categorizes objectives from the simple to the complex or from factual to conceptual. The key elements of Bloom's taxonomy [22] are illustrated on the Table 2.

This is a critical first step because with a well written objective, an instructor can then create an entire lesson.

3.1.6.2 Step two: Organize content

Once the learning level of the objective is determined, it is time to begin to sketch out the lesson. Let's say the objective of a lesson is: Identify basic concepts and definitions of global health. All lesson activities should then be directly related to the objective. To illustrate the point here, Fig. 2 is what the UGHE e-Learning

Table 2. The key elements of Bloom's taxonomy

Level of learning	Description & activity
Knowledge	Basic recall of information (Behaviorist learning theory applied)
Comprehension	Translating, interpreting or extrapolating
Application	Using principles to solve problems
Analysis	Breaking down complex information into simpler parts
Synthesis	Creation of something that did not exist before (Constructivist design may be used)
Evaluation	Judging something against a standard

Department created in form of a very simple course development form that is intended to perform as a link between previously created content and a course in the learning management system, Canvas. The course development form operates as a way to make sure that all critical lesson contents have been created, and it acts as a way to track and organize work.

Once the course development form has been filled out and the elements of the form have been created, the components of the form can be placed into a learning management system.

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Online Course Development Form

Module 1 Objective: Identify basic concepts and definitions of global health.				
Start	**Activity**	**Description**	**Due**	**Hours**
Week 1	Introduction (Video)	View welcome video	05/12/21	1
	Video	Video: Global Health Equity	05/15/21	1
	Readings	Mukherjee, J. (2017). An introduction to global health delivery: Practice, equity, human rights. Chapters 1 and 2.	05/15/21	2
	Assignment	Write a two- page article on the history of global health. Use five sources	05/15/21	4
	Discussion	Answer Discussion board question two.	05/12/21	1
	Assessment	Quiz two	05/13/21	1
	Blended element	Prepare for classroom presentation on history of global health	05/20/21	4
	Virtual Office Hours	See hours listed.		

Fig. 2. An online course development form

Fig. 3. Instructional design and organisation of resources on the learning management system

3.1.6.3 Step three: Place content in LMS

Because the course development process begins with objectives, all developed content matches objectives and mirrors sections of the learning management system. For example, in the example above all created content matches sections that are a part of the LMS your institution chooses.

3.1.6.4 Step four: Evaluate

Evaluation is the final stage of the ADDIE Model, but it is a process that should be occurring throughout all the stages. Evaluation is important because it informs stakeholders if the course development processes put into place are working to produce the desired result.

3.2 Pedagogy: Recommending a Blend

3.2.1 Learner-centered teacher-facilitated methods

3.2.1.1 Flipped classes- with in-class quizzes

Using the flip class has the benefit of facilitating self-directed learning, which according to Knowles is more suitable for the adult learner. A major benefit of this in the current context however, is that it reduces dependencies on long one-sided or 'teacher-sided' 'lecturers' that would not in any suitably replace what an ideal classroom lecture could have been. This rather allows the teacher to provide materials for the learner ahead of class. These materials are studied with specific instructions and activities. The class time is reserved for clarifications, interactions, discussions and very robust application activities.

3.2.1.2 Interactive virtual lectures with post-class MCQs

Interactive lectures might be used alongside other methods. The advantage of this is that it allows the teacher to directly teach certain important concepts that might be essential and that learners might find difficult to digest through personal studies. To achieve optimal results, a suitable medium that allows for quality communication such as a video-conferencing platform, quality internet connection in order not to frustrate the teacher's efforts and the students interest in learning as well as an interactive LMS compatible platform to allow interactions is important. For instance, Zoom would allow students to raise their hands to ask questions, while it also provides room for sending questions and queries as texts. It also allows learners to have breakout sessions for group exercises and activities.

3.2.1.3 Virtual TBL: With iRAT, tRAT, application questions

Team Based Learning [TBL] is a collaborative method of learning that emphasizes the affective aspect of learning in addition to the cognitive to help learners to develop affective skills by facilitating collaborative learning and cooperative behaviours among learners. It is highly structured as it provides pre-class materials and are required to study before class and do a pre-class Individual Readiness Assurance Test [iRAT], this is followed by the Team Readiness assurance Test [tRAT] after which there will be appeals and clarifications. A mini lecture might be introduced to emphasise the essentials and drive home key points. Application problems constitute a major class activities and lessons, having quality knowledge of concepts are required to put it to use in solving problems during the TBL sessions. Online TBL sessions can be conducted with appropriate technology; Intel Dashboard provides a useful planform and resources for assessment. Zoom, because of its possible breakout sessions can be creatively adapted to support TBL sessions; so also, any other platform such as the *InteDashboard* with such potentials.

3.2.1.4 Virtual CBCL: With cases, guided discussions and feedback

Case-based collaborative learning [CBCL] uses cases to drive learning in applied or application forms. This might be adapted for eLearning or virtual learning as cases are presented and theoretical knowledge is required to be used to address the problem, under the guidance of a skilled teacher or facilitator. A guide might be used to mark key learning milestones. In an online environment, virtual presentation of real or animated cases could be used to facilitate productive CBCL sessions with properly highlighted objectives, effective strategies and proper facilitation.

3.2.2 Learner-centered learner-self directed methods

Adult learners are preferably self-directed; hence, opportunities should be given for self-directed learning in a blended way. To achieve this, the following may be of help:

3.2.2.1 Academic posts

Asking learners to read carefully selected materials and providing them with applied problems that require reading and providing answers as 'academic posts' will greatly help learners to appreciate concepts. Furthermore, using a forum-like model, the students see one another's post is a way to learn from one another. Regular teacher comments and feedback would greatly help to guide learners and direct the learning process effectively.

3.2.2.2 Reflections journal

Reflective practice is very effective at helping learners make original reflective sense out of what they have learned in principle. To achieve good results, asking students to be involved in regular reflective practices, such as weekly or twice a week on specific topics and concepts would help with deep reflections that reinforces learning and also provides quality feedback on whether lenses and learning are based on the learning objectives.

3.2.2.3 Learner's forum

A learners' forum usually built into the Learning management system [LMS] is a very important one to create a community. The teacher simply provides prompts that initiate discussions among learners and ensure ongoing conversations. Learners' forums are usually not graded like academic posts but what is rather rewarded is participation.

3.2.2.4 Community of practice

This is attributed to Lave and Wenger [23]; although it is often used in the context of professional community and common-interest networks; the basic principles can be applicable to online learning because it basically creates a community for sharing knowledge, information and resources. This implies that the use of this method can enable learners to connect within a whole institution or the same domain of learning between many institutions. More knowledgeable and experienced colleagues could share ideas and experiences as well as information and resources; thus, creating a community of learning and common interest for development.

3.2.3 Use of multimedia

3.2.3.1 Animations

Animations will provide dynamic and intellectually stimulating material for the understanding of very key concepts. This can provide virtual means of appreciating skills and learning fundamental principles that might be put to use by the learners whenever the opportunity is presented.

3.2.3.2 Visualizations

Visualizations could be programmed or designed virtual illustrations of concepts that could help to facilitated comprehension and understanding. Rather than prolonged theorical and abstract explanations, shorter texts could be used with visualizations to facilitate learning better.

3.2.3.3 Recorded videos

Recorded videos of lectures can be provided to students. Students can watch this in lieu of live lectures. They might also be complementary materials after lectures or other forms of learning. A teacher can easily create their own lectures with computer enabled software such as the Camtasia and PowerPoint mix [on windows]. Some institutions have video conferencing facilities that can record high quality videos of lectures that could be provided to users through the LMS.

3.2.3.4 Educational games

Educational videos are known to have educational theoretical basis. Gaming for instance comes with rewards for success and punishment for errors or poor performances. This could drive learning, serving as a form of operant conditioning or modelling as in behaviorism. The use of edutainment or gaming to drive leaving was described as edutainment. Another benefit of this is that it makes learning fun and reduces boredom or distraction, thus reinforcing learners' affinity for learning.

3.3 Teachers Needs

3.3.1 Quality materials to work with

Teachers will need quality materials to work with. These would include quality books or texts, preferably open access to avoid restrictions and legal challenges. Others might be videos, animations and illustrations.

3.3.2 Training

Certain teaching methods need knowledge of relevant theories and fundamentals as well as facilitating skills to deliver. TBL, CBCL for instance require that teachers are adequately

knowledgeable about the guiding principles and skills in the use of the basic methods.

3.3.3 Quality onboarding/orientation

Onboarding is essential. It is advisable that train-the-trainer sessions are organised for teachers; short and effective videos and animations might be provided as references and for continuing learning in such a way that they can model best practices.

3.4 Learners' Needs

3.4.1 Quality materials

There are materials that could greatly help to facilitate online learning; this include OERs, Videos, Virtual illustrations, recorded cases, online fora etc.

3.4.2 Quality onboarding

Transitioning online might not be quite easy for learners, but the process would be a lot more effective with quality onboarding.

3.5 A Note on Assessment Materials

Online assessment would consider the primary domains of assessment - cognitive, psychomotor or affective or the level, using Bloom's taxonomy -recall or higher orders. MCQs are considered effective for many online learning sessions because of their reliability and consistency at testing the same thing. There is the need for adequate skills on the part of the examiner as well as quality understanding of the guiding principles.

3.6 Recommendations

1. Use suitable pedagogy- delivery methods
2. Provide adequate resources
3. Train the teachers
4. Ensure proper onboarding for learner and teachers

4. RESOURCES: MAKING A STRONG CASE FOR OERS

4.1 Why OERs

Covid-19 has presented unprecedented challenges to all spheres of our lives. Education is no exception. Covid-19 has resulted in massive school closures and turned the traditional educational model on its heels. Covid-19 has resulted in a paradigm shift on how learning is delivered. With the closure of learning institutions, the education community is faced with the challenge of providing learning opportunities in an environment like no before. In this special situation, the Open Educational Resources (OER) now have ever-increasing vital roles to play in how learning is and is going to take place in the Covid-19 era.

It is crucial to understand the role of OER during the Covid-19 era. According to UNESCO [24], China's 1.2 billion learners were affected by the closure of learning institutions during the onset of Covid-19. This accounted for 69.3% of the world's student population. Using Information Communication Technologies (ICT), to offer learning solutions is China's preferred way of continuing with learning. Open Education (OE) is a way of carrying out education, often using digital technologies. Its aim is to widen access and participation to everyone by removing barriers and making learning accessible, abundant, and customizable for all. It offers multiple ways of teaching and learning, building, and sharing knowledge. It also provides a variety of access routes to formal and non-formal education and connects the two [25].

According to Bao [26], it requires a great deal of effort to move courses online. In general, a complete online course requires an elaborate lesson plan design, teaching materials such as audio and video contents, as well as technology support teams. However, due to the sudden emergence of the COVID-19, most faculty members are facing the challenges of lacking online teaching experience, early preparation, or support from educational technology teams [26]. In order to remedy this issue, many institutions have turned to Open Educational Resources.

4.2 Understanding OERs

The term Open Educational Resources (OER) was first introduced at a conference hosted by UNESCO in 2000 and was promoted in the context of providing free access to educational resources on a global scale. There is no authoritatively accredited definition for the term OER at present; the most often used definition of OER is, "digitized materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research" [27,28]. OER are distinguished from other educational resources by their characteristics of being legally free to access,

copy, distribute, use, adapt or modify [24]. OERs are considered to be a means for making educational content more accessible to educators and students, especially in economically depressed regions where textbooks and other learning resources are scarce and/or costly [29]. According to Hodgkinson & Arinto [29], one can engage with OER based on the following:

1. Using OER 'as is"
2. Adapting OER to various scenarios.
3. Creating new OER.

Whichever way one engages with OER there is a need to acknowledge that they play an ever-increasing important role in education.

4.3 OERs Enablers

OER are a powerful means of bridging the learning gaps. However, it is important to note that the success of OER is dependent on constant engagement by faculty. The need to cultivate, nurture and maintain faculty engagement is key to the success of OERs [30]. Efforts should be made to ensure that faculty are incentivized to use and adopt OERs.

Other enablers of OER have been cited as being, government policies as regards internet and internet use, international funding organizations, competition amongst learning institutions to provide OERs and technological changes especially in open source software development [31]. These enablers have come under intense scrutiny more so during the Covid-19 pandemic. Governments have been challenged to reconsider various policies regarding internet use, academic institutions have been forced to adapt to online modes of learning including OERs, online conferencing software and platforms have also seen exponential growth. All these are a pointer that traditional learning has been transformed in a blink of an eye.

4.4 OERs Policies

Various policies guide the adoption and use of OERs. The anchoring policy in OERs is Open Access (OA). Open Access has been defined variously. However, the recurring theme is that in one way or another access to information material is made as free as possible to the end-user. Despite the growth in OERs, few institutions have developed and implemented formal OER policies [32]. Most commonly, Intellectual Property Rights (IP) and Copyright issues have a major impact on the development of OERs policies at institutional and/or national level. Creation, distribution and or copying of OER will be affected in one way or another by IP and Copyright issues. Higher education institutions should take into consideration these issues as they develop OER policies that will guide them.

Human resources policies also play a part in developing an overall OER Policy. The human resources policy can determine whether works are produced as part of the faculty's job description, extra work, remuneration for work done and even promotional purposes for faculty. Critical to OER is Information Communication Technology (ICT) and as such institutional policies relating to ICT should be geared towards promoting and developing OERs. Hardware, software, internet and technical support are key components of the OER Policy.

Wiley [33] suggested that there are 3 models of offering OER at higher education: the MIT model, the USU model, and the Rice model. These models adopt different approaches from being highly centralized (MIT model) in content creation to very decentralized (Rice Model) in the same. The three main models show the versatility of OERs and that there is no-one-fit all model and institutions that go OERs will need to adopt any model to fit their own needs.

It has been argued that policy can accelerate or impede the adoption and creation of OER [34], and will help institutions to manage and archive their material better, whilst stimulating internal improvement, innovation and reuse [35]. In addition, the issue of policy is usually part of discussions about ensuring the sustainability of OER at institutions. Whereas is important to consider the relevance of OER policies in higher education settings, these policies are not the be-all-and-end all, as policy fulfils a limited function. Other issues are likely of equal relevance, including faculty buy-in and involvement, enabling of technology environments, funding, sustainability, and motivation and reward systems to facilitate the active participation of stakeholders.

4.5 OER Best Practices

OER are increasingly becoming part of the range of materials that learners and educators can use [36]. However, the methods and practices that

enable learners, teachers and institutions to best engage with OER are not yet established and may well be more important in enabling change in education systems than the availability of the resources themselves. According to McAndrew [36], the need to have best practices in OER cannot be overstated. The suggested principles that should guide the development of best practices in OER are:

1. Infrastructure: This relates to the policies, software, hardware and tools needed to a conducive environment that fosters the creation and sharing of OERs.
2. Use: With the greater availability of content there is more opportunity for use and to recognise the way in which OER can act as an attractor for communities of learners. Social spaces can be established on top of the content. so even in a move towards greater value in social learning and the gaining of "21st Century Skills" the role of content as a way to bring people together and allow self-directed learning is a great enabler of learning
3. Design: OERs should be designed for openness both in terms of the content itself, but also the models for use of educational contents. Research has shown [28] that considering designing for use of the content and establishing patterns around free and open content may bring benefits more quickly than embedding the design in the materials.
4. Adoption: This deals with how to make use of OER as the basis for the practice of institutions and individuals. Do institutions fully, partially or occasionally adopt OER? And to what level of engagement should institutions: Using OER 'as is", adapting OER to various scenarios and /or lastly creating new OER.
5. Policy: An increasingly important aspect of OER is the recognition that they have characteristics to support change at many levels, including institutional and national policies. Adjusting the copyright and permissions to content may seem like a minor change. However, the use of openness has enabled the crossing of barriers and an easy path for sharing experiences without having to establish all agreements and components.

The greater spread and availability of Open Educational Resources has given a platform for change and adoption of Open Educational Practice. These require a process of change and development if they are to give the greatest benefit. Open approaches continue to develop and it remains clear that there is much to learn from new contexts and systems in this period of change.

4.6 Sources of OERs

Faculty and learners can find OER in a variety of resources. Most OER organizations or collaborations have a database or central list of resources that faculty have added. Some databases also feature annotations or faculty feedback. However, it is key to remember that OER refers to educational materials that include permission for anyone to use, modify and share. If any material that has been recommended for use does not meet these characteristics then it ceases to be an OER.

OERs can be organised in various ways. These include:

1. As complete courses: Here various institutions organise resources in the form of a course and provide course materials for free. These courses are mostly offered under the Massive Open Online Course (MOOCs) method. Examples of these MOOCs sources include, but are not limited to:

   a. Edx (www.edx.org)
   b. Coursera (www.coursera.org)
   c. Udacity (www.udacity.com)
   d. MIT OpenCourseWare (www.ocw.mit.edu)

2. Those that use multimedia as the main medium of instruction: Here the OERs tend to use various multimedia as their means of instruction.

   a. TED (www.ted.com)
   b. Khan Academy (www.khanacademy.org)
   c. TEDEd (www.ed.ted.com/)

3. Open Access Books: These provide access to books mainly textbooks used at various learning stages.

   a. OpenStax College (www.openstax.org)
   b. Project Gutenberg (www.gutenberg.org)
   c. FreeBooks4Doctors (www.freebooks4doctors.com)
   d. Open SUNY (www.textbooks.opensuny.org)

4. Large Repositories: These are repositories that allow searching and retrieval of materials in various formats.

a. OASIS (www.oasis.geneseo.edu)
b. Merlot (www.merlot.org)
c. OER Commons (www.oercommons.org)

5. Open Access Journals:

a. Directory of Open Access Journals (www.doaj.org)
b. Betham Open (www.benthamopen.com)
c. Public Library of Science (PLOS)-(www.plos.org)

5. INFRASTRUCTURE: LMS, ICT, SYSTEM AND CONNECTIVITY

The global pandemic related to COVID-19 has created many challenging situations, including those that particularly affect institutions of higher education. As a response to this crisis and future crises, institutions have to respond by diversifying methods of course delivery to include virtual teaching. Supporting virtual teaching in a unique situation like COVID-19 requires investments in high-end and centralized infrastructures, learning management systems, online resources, and most importantly, efforts in new ways of teaching and learning. The adaptation and changes in pedagogy and instructional design must also ensure the same quality of teaching during a global pandemic and maintain uninterrupted learning for students. African education systems will need to put in place an educational technology strategy that supports this shift. To successfully, adapt existing systems to support online teaching and learning, the following factors need to be given adequate considerations:

5.1 Learning Management System

Individual institutions need to solidify their online learning plans and strategies by investing in infrastructure and resources to support a stable Learning Management System for asynchronous learning, a video meeting solution for synchronous sessions, and a secure assessment platform. Local and national governments may help enable distance learning by investing in upgraded infrastructure in communities and providing subsidized data costs to students. In the absence of subsidized costs, institutions can step in and provide stipends for students on financial aid to assist them with the data and equipment costs necessary for an effective learning experience.

5.2 ICT Security and Privacy Concerns

There are however challenges that need to be addressed within the plan. Security and privacy concerns are multiplied as ICT staff can no longer manage the data network used by students and faculty. Therefore new systems and processes implemented must ensure that student data remains protected. Equity among students may also be a concern that needs to be monitored. Institutions and governments must provide solutions in situations where a student's living or financial circumstance provide a less-than-equitable environment for learning.

5.3 Integration

Finally, developing a model for virtual or online learning should not be seen as a burden, but rather an opportunity for institutions to expand their reach and enable a more dynamic curriculum and educational system. A well thought out plan will allow institutions to effectively educate learners beyond the walls of their buildings and no longer be limited by space or travel constraints. A curriculum as a school that is designed for distance education can provide more engagement through individualized or small-group learning activities and by allowing learners to grasp concepts at their own pace.

6. CONCLUSION AND FINAL RECOMMENDATIONS

In conclusion, there is a need to ensure that institutions in their attempt to transition to online e-learning are able to adapt their existing structure to support the necessary transitions. While adequate emphasis should be laid on teaching, especially the pedagogy, infrastructures and quality virtual learning environment also deserve quality attention. Assessment methods and support systems should follow evidence-based and best practices. It also important to emphasise that without synchronizing methods and infrastructures with an enabling virtual learning infrastructure, the ongoing adaptations might be dysfunctional, creating fallouts that could ridicule the ongoing efforts.

Finally, the following recommendations might be helpful:

1. Determine the most appropriate pedagogy
2. Adopt best practices for online teaching
3. Create an ideal virtual environment using appropriate LMS
4. Use readily available resources, especially, electronic resources and open educational resources.

5. Develop an effective support system and an enabling culture that is suitable for virtual learning systems.
6. Connect learners through a learning community
7. Ensure that the available technology can support online learning.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Lone SA, Ahmad A. COVID-19 pandemic - an African perspective. Emerging Microbes & Infections. 2020;9(1):1300-1308. DOI: 10.1080/22221751.2020.1775132
2. Kay D, Kibble J. Learning theories 101: Application to everyday teaching and scholarship. Advances in Physiology Education. 2016;40(1):17-25.
3. Kratochwill TR, Bijou SW. The impact of behaviorism on educational psychology. In: Glover JA, Ronning RR, (Eds) Historical Foundations of Educational Psychology. Perspectives on Individual Differences. Springer, Boston, MA; 1987. Available:https://doi.org/10.1007/978-1-4899-3620-2_8
4. Murtonena M, Gruberab H, Lehtinena E. The return of behaviourist epistemology: A review of learning outcomes studies. Educational Research Review. 2017;22: 114-128.
5. Winn W. Some implications of cognitive theory for instructional design. Instr Sci. 1990;19:53–69. Available:https://doi.org/10.1007/BF00377985
6. Yilmaz K. The cognitive perspective on learning: Its theoretical underpinnings and implications for classroom practices. The Clearing House. 2011;84(5):204-212.
7. Taylor DC, Hamdy H. Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. Med Teach. 2013;35(11): e1561-72. DOI: 10.3109/0142159X.2013.828153 Epub 2013 Sep 4 PMID: 24004029
8. Sjøberg S. Constructivism and learning. In: Penelope Peterson, Eva Baker, Barry McGaw, (Editors), International Encyclopedia of Education. 2010;5:485-490. Oxford: Elsevier.
9. Duke B, Harper G, Johnston M. Connectivism as a digital age learning theory. The International HETL Review-Special Issue. 2013;4-13.
10. Utecht J, Keller D. Becoming relevant again: Applying connectivism learning theory to today's classrooms. Critical Questions in Education. 2019;10(2):107-119.
11. Siemens G. Connectivism: A learning theory for the digital age; 2004. Available:http://www.elearnspace.org/Articles/connectivism.htm
12. Siemens G. Connectivism: A learning theory for the digital age. International Journal of Instructional Technology and Distance Learning. 2005;2(1). Available:http://www.itdl.org/
13. Wilkerson L, Irby DM. Strategies for improving teaching practices: A comprehensive approach to faculty development. Acad Med. 1998;73:387–396.
14. Bandura A. On the functional properties of perceived self-efficacy revisited. Journal of Management. 2012;38(1):9-44. DOI: 10.1177/0149206311410606
15. Sandars J. The use of reflection in medical education: AMEE Guide No. 44, Medical Teacher. 2009;31(8):685-695.
16. Kolb A, Kolb D, Passarelli A, Sharma G. On becoming an experiential educator: The educator role profile. Simulation & Gaming. 2014;45(2):204-234. Available:https://doi.org/10.1177/1046878114534383 (Accessed: 18 March 2020)
17. Knowles M. Andragogy in action. San Francisco: Jossey- Bass; 1984.
18. Argyris C. Teaching smart people how to learn. Harvard Business Review. 1991;69(3):99–109.
19. Kolb A, Kolb D. Eight important things to know about the experiential learning cycle.

Australian Educational Leader. 2018;40(3): 8-14.
20. Reiser RA, Dempsey JV. Trends and issues in instructional design and technology (3rd Ed.). Boston, MA: Pearson Education, Inc; 2012.
21. Aldoobie N. ADDIE model. American International Journal of Contemporary Research. 2015;5(6):68-72.
22. Bloom B, Englehart M, Furst E, Hill W, Krathwohl D. Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain. New York and Toronto: Longmans, Green; 1956.
23. Lave J, Wenger E. Situated learning: Legitimate peripheral participation. Cambridge: Cambridge University Press; 1991.
ISBN 978-0-521-42374-8
24. UNESCO. Guidance on open Education Practices during school closures. 2020; 80.
Available:https://www.google.com/search?q=guidance+on+open+Education+Practices+during+school+closures&rlz=1C5CHFA_enRW901RW901&oq=guidance+on+open+Education+Practices+during+school+closures&aqs=chrome..69i57.23824j0j4&sourceid=chrome&ie=UTF-8
25. Dos Santos AI, Punie Y, Castaño-Muñoz J. Opportunities and challenges for the future of MOOCs and open education in Europe. Books to MOOC. 2016;81–91.
26. Bao W. COVID-19 and online teaching in higher education: A case study of Peking University. Human Behavior and Emerging Technologies. 2020;2(2):113–115.
Available:https://doi.org/10.1002/hbe2.191
27. OECD. Centre For Educational Research and Innovation. Giving knowledge for free. The Emergence of Open Educational Resources. Organisation for Economic Co-Operation and Development; 2007.
Available:http://www.oecd.org/education/ceri/givingknowledgeforfreetheemergenceofopeneducationalresources.htm
(Accessed 3rd November, 2020)
28. Dimitriadis Y, McAndrew P, Conole G, Makriyannis E. New design approaches to repurposing open educational resources for collaborative learning using mediating artefacts. 2009;201–207.
Available:http://www.ascilite.org.au/conferences/auckland09/procs/dimitriadis.pdf
29. Hodgkinson-Williams C, Arinto P. Adoption and impact of OER in the Global South. African Minds. Cape Town: University of Cape Town (ROER4D), IDRC; 2017.
Available:https://library.oapen.org/handle/20.500.12657/29431
30. Browne T, Holding R, Howell A, Rodway-Dyer S. The challenges of OER to academic practice. Journal of Interactive Media in Education. 2010;1:1-15.
31. Yuan L, MacNeill S, Kraan WG. Open educational resources-opportunities and challenges for higher education; 2008.
Available:http://publications.cetis.org.uk/wp-content/uploads/2012/01/OER_Briefing_Paper_CETIS.pdf
(Retrieved October 8, 2020)
32. Hoosen S, Butcher N. Experiences of developing OER-amenable policies. Open Educational Resources and Change in Higher Education: Reflections from Practice. 2012;217.
33. Wiley D. On the sustainability of open educational resource initiatives in higher education; 2006.
Available:www.oecd.org/edu/oer
(Accessed 3rd November, 2020)
34. Plotkin H. Free to learn: An open educational resources policy development guidebook for community college governance officials. San Francisco: Creative Commons; 2010.
Available:http://wiki.creativecommons.org/images/6/67/FreetoLearnGuide.pdf
35. Joyce A. OECD study of OER: Forum report. Paris: International Institute for Educational Planning; 2006.
Available:http://oerwiki.iiep.unesco.org/images/e/ea/Oer_forum_report.pdf
36. McAndrew P. Fostering open educational practices. ELearning Papers. 2011;23.

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