Strategies Used to Teach Online in an EdTech Low-resource Environment during COVID-19: A Qualitative Case Study of the University of Zambia

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Strategies Used to Teach Online in an EdTech Low-resource Environment during COVID-19: A Qualitative Case Study of the University of Zambia

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Abstract

The traditional form of teaching in Zambian universities often involves on-site lectures being given to students, accompanied by physical tutorials. However, during the unprecedented outbreak of the COVID-19 pandemic, universities have had to urgently transition toward online instruction in an EdTech low-resource environment. Two years into the transition, it is vital to highlight challenges and examine strategies lecturers use when teaching online lessons in an EdTech low-resource environment.

The study is anchored on the interpretivist worldview. The researchers adopted a qualitative approach and specifically evoked a case study design. They purposefully sampled 21 participants from three faculties of the University of Zambia: the School of Education, the School of Humanities and Social Sciences, and the School of Health Science. The study attempted to answer four questions: (a) What online instructional devices and resources are available for lecturers? (b) How do lecturers describe the level of usage of online instructional resources across the curriculum? (c) What are lecturers' perceptions and experiences of online instructional resources? (d) How do lecturers describe strategies used to mitigate the challenges of online instructional resources? Data were collected using an interview schedule, via face-to-face interviews, phone interviews, and WhatsApp. Results are presented in tables and figures as well as verbatim statements of the respondents. The researchers used Braun and Clarke's (2006) six-step recursive thematic analysis to generate codes and the themes presented in the study.

The findings of the study, though focused on Zambia, do rather easily reflect the situation and experience of other countries with similar characteristics. The study has established that lecturers in an EdTech low-resource environment are fully aware of the possible challenges online instruction offers. The results also demonstrate that lecturers have devised coping strategies that enable them to teach amidst the struggles of online teaching. These strategies are lecturer-oriented, lesson-oriented, resource-oriented, and student-oriented. Further, findings are that for online instruction to be successful in an EdTech low-resource environment, the following should be considered: lecturers' desire to learn, availability of basic ICT devices, use of open educational resources (OER), the potential of the use of devices, and availability of internet connectivity. The study recommends that higher learning institutions must

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equitably provide the necessary EdTech devices, software and other tools to lecturers in order to enhance the online teaching experience. Where possible, external support—such as import duty exemptions or corporate sponsorships and donations—should be sought, to enable universities and colleges to facilitate learning. For further research, the study recommends an examination of lecturers' awareness and use of various open educational resources for effective teaching, learning, and planning.

This study provides important insights and mitigation measures for higher education institutions engaged in online instruction in EdTech low-resource environments, thereby helping to create a better online teaching and learning environment. The study further contributes to ongoing scholarship on strategies that can be used to improve the online teaching and learning experiences of higher education, providing the much-needed insight from Zambia and the Global South at large.

Keywords: Strategies, EdTech low-resource environment, teaching, Universities, COVID-19

1 Background and Relevant Studies

Technology is perhaps the strongest factor shaping the educational landscape in the times of the COVID-19 pandemic and beyond. It is no gainsaying that the COVID-19 pandemic has brought with it a gradual change in the world order leading to 'business unusual' in all facets of life and livelihood (Patrick et al., 2021). African Universities including the University of Zambia (UNZA), have had to embrace the benefits of educational technologies in EdTech low-resource environments during the pandemic to remain relevant and competitive. EdTech is short for education technology and refers to new technological implementations in the classroom. This involves the use of in-classroom tablets, interactive projection screens and whiteboards, online content delivery, and MOOCs among others (Weller, 2018). Through this adoption and adaptation to the 'new normal' lecturers in higher learning institutions in Zambia have no option but to leverage assets available to them to facilitate virtual learning. Most available online instructional resources are open educational resources implying that both lecturers and students have easy access to them. The open and free resources among others include Google Meet, Google Classroom, free Zoom session, Moodle and most recently used by educators the WhatsApp messaging system. According to Patrick et al. (2021) in South Africa, moving from the traditional forms of teaching and learning saw an increase in the use of online alternatives such as Zoom, WhatsApp, Moodle, Blackboard and e-mails for teaching and learning across all educational spaces. The effectiveness of these technologies and their educational impact on the educational sector has been the concern of researchers during the spread of the pandemic consequently, this study. Data from Internet World Stats show that at least one-half of the Sub-Saharan African countries have less than 50% of their population with no access to the internet. Only 10% of the population of poorly developed Sub-Saharan countries like Rwanda, Burundi, Chad, Madagascar, South Sudan, and Western Sahara countries have access to the internet. These limitations further complicate the need to implement remote learning or any other instructional methods that are

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facilitated by the internet. Such demerits that face most of the Sub-Sahara Africa countries demand for comprehensive measures in terms of preparedness and resource allocations to limit negative educational consequences arising from epidemics and pandemics (Ayega, 2020)

Globally, scholarship related to COVID-19 and education (Bao, 2020; Dhawan, 2020; Lufungulo et al., 2021; Mwila et al., 2021) highlights the attitudes of lecturers and students towards online instruction, challenges of online instruction, and also the impact COVID-19 has had on education in general. The current study explores lecturers' experiences with online instruction two years into the pandemic and identifies strategies that have been used to mitigate the challenges of online instruction in an EdTech low-resource environment. A similar study conducted in Zimbabwe by (Chingara et al., 2021) offers insights into how online instruction, can be sustained in universities in developing countries, using a minimalist approach, during a crisis such as COVID-19. The findings reveal that using a few online tools and applications, lecturers in Zimbabwe are able to conduct online classes. The study by (Chingara et al., 2021) is essential for the current study on two fronts, firstly it references a theoretical perspective used in the present study, and secondly, it provides a base on which a comparison between the Zimbabwean case and Zambian case is made.

Furthermore, there is a fast growing COVID-19 related literature that provides some useful insight to the present study. Rahman et al. (2021) in an article entitled, "*Teaching and Learning Calculus through Google Meet Platform During the COVID-19 Pandemic: Implementation and Evaluation*" concludes that to make sure that no students are left behind, using a simple application like Google Meet where everyone can access for free is the best option. Majority of the students prefer to use Google Meet platform due to its valuable features which other tools do not offer. Another study has shown that Moodle is one of the effective platforms that have been used where students have shown a positive impression (Saqr et al., 2020). Similarly, (Pal & Vanijja, 2020) adopted a survey among university students that measured the usability of Microsoft Teams as a reference platform using the (Technology Acceptance Model) TAM model. The study concludes that the effectiveness of these platforms is highly evident, especially in developing countries where perceived usability is highly evident. Al-Maroof et al. (2021) Found out that the effectiveness of online platforms largely depends on ease of use, usefulness, perceived value, and enjoyment. These have a positive role in the reduction in fear and skepticism of use of the online platforms. Simply put, the perceived fear towards use of online platform is reduced whenever the students and teachers implement an easy-to-use online platform that is technically and personally useful. Furthermore, when teachers and students enjoy the use of an online platform, this affects the communication process among teachers and students, resulting in better learning styles, efficient e-course material, and positive perception on behalf of students and ultimately improves the teaching and learning process.

Two years into the pandemic, it is essential to examine the challenges lecturers face as they interact with different online instructional tools and resources and identify ways in which they mitigate these challenges.

This study is essential because it points out how higher learning institutions in Zambia continue to respond to the COVID-19 pandemic in an EdTech low-resource environment and further highlights the prospect of online instruction, and the measures that support the successful integration of technologies in teaching and learning.

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1.2 Statement of the Problem

It is no gainsaying that the COVID-19 pandemic has brought with it a gradual change in the world order leading to 'business unusual' in all facets of life and livelihood (Patrick et al., 2021). In the education sector COVID-19 led to the transformation of forms of teaching from the traditional in-class to online instruction. Scholarly evidence (Bao, 2020; Rapanta et al., 2020; Sarkar et al., 2021) indicates that urgent online teaching and learning has had numerous challenges ranging from attitude towards the use of the educational technologies, technical knowhow issues and availability and affordability of these tools and resources. To remain relevant and competitive, universities around the world have had to adopt and adapt to technologies that were previous not a part of their teaching and learning process. However, in most developing countries in sub-Sahara Africa universities have had a challenge to provide basic online teaching and learning tools to both the lectures and students (Chingara et al., 2021; Lufungulo et al., 2021; Mwila et al., 2021). Despite the foregoing scenario somehow lecturers managed and continue to use online tools and resources for their classes. Two years into the pandemic, strategies lecturers use when using online tools and platforms to teach in an EdTech low-resource environment has not yet been clarified, so it is not obvious to state how online classes and blended teaching and learning has been conducted hence this study. The current study is imperative because it provides insights into how developing countries can sustain online instruction in an EdTech low-resource environment. Without these insights universities in developing countries may continue to lag behind and struggle with how to navigate online instruction in an EdTech low-resource environment without making any positive stride towards improved online and blended teaching and learning.

1.3 Research Questions

1.3.1 What online instructional devices and resources are available for lecturers?
1.3.2. How do lecturers describe the level of usage of online instructional devices across the curriculum?
1.3.3 What are lecturers' perception and experiences towards online instructional resources?
1.3.4. How do lecturers describe strategies used to mitigate challenges of online instructional resources?

1.4 Theoretical Framework

The minimalist approach to online instruction anchors the study. Minimalists' theories argue that online instruction should only include that which provides significant and demonstrable benefits to a student's course (Chingara et al., 2021; Wolverton & Hollier, 2019). Instructors and learners do not require so many gadgets and software resources in order to have a successful online lesson. Minimalism is based on constructivism which encourages creativity and the use of available resources to function. The theory states that adult learners are not blank slates they already have a wealth of experience and prior knowledge tucked away in their memory, which

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should be regarded as invaluable assets (Carroll, 1990). Thus, even with minimal online instruction tools and resources both lecturers and students can successfully interact online. Minimalism promotes the use of only a limited amount of online resources and has been proven to foster creative behavior.

The intention is not to imply that the investment of resources is unnecessary instead, by adopting a minimalist approach, an institution can become more intentionally resourceful; seeking to achieve its goals with the resources it already possesses more than it seeks additional resources, which it assumes will improve online instruction (Chingara et al., 2021). The minimalist approach encourages and hopes to persuade lecturers and students to be intentionally resourceful by using what they already possess than to seek additional resources, which they assume will improve online teaching and learning. Therefore, in an EdTech low resource environment like the University of Zambia, seeking more sophisticated technologies to improve teaching and learning during the COVID-19 pandemic may not be attainable presently due to competing needs, priorities and financial constraints. Thus, the focus should be on identifying available technologies that can deliver lessons with the use of minimal online teaching and learning tools and resources.

According to Wolverton and Hollier (2019) online instruction can be attained in a minimised way under three vital conditions. The first being availability of a reliable internet connection. Secondly, the use of laptops and smart cell phones. and lastly but not the least specific- software applications. These three components are essential at enabling communication between lecturers and students for instance in the presence of internet connectivity, laptops and smart phones are the most basic tools lecturers and students can stay in touch for online and blended teaching and learning. Even though most students in developing countries cannot afford laptops for their online classes they join classes and access their course materials using smart phones (Chingara et al., 2021; Mwila et al., 2021). Albeit some parts of Zambia have erratic internet, most parts of the country have reliable internet services provided by the three leading internet service providers including Airtel, MTN ZAMTEL and Liquid Telecom. Through these service providers lecturers and students stay in touch online. Mobile internet accounts for most of the access in Zambia and this has been driven by factors such as lowered costs for mobile broadband data and the spread of cheap, easy to use internet-capable mobile handsets (Mambwe, 2015; Zicta & Communications Technology, 2021).

1.5 Methodology

The present study is anchored on the interpretivist worldview. This approach tries to 'get into the head of the subjects being studied' so to speak, and to understand and interpret what the subject is thinking or the meaning s/he is making of the context (Kivunja & Kuyini, 2017). Its greatest strength is the wealth and deepness of investigations and descriptions it yields (Chingara et al., 2021). The interpretivist approach guides this study to examine lecturers' experiences with the use of online instructional resources, the challenges faced and the strategies they employ to mitigate challenges of online instruction in an EdTech low-resource environment. The interpretivist way of thinking enabled the researchers to study the subjects (lecturers) experiences and actions in their natural environment (UNZA).

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The researchers adopted a qualitative approach and specifically evoked a s case study design. According to Creswell (2014) in qualitative approaches researchers build a complex, holistic picture, analyzes words, reports detailed views of informants and conduct the study in a natural setting. Furthermore, the researchers used the case study as its research method. Starman (2013) further elucidates that case studies are especially valuable in practice-oriented fields (such as education, management, public administration, and social work). This research creates a holistic picture of phenomena under study using lived experiences of the lecturers at the University of Zambia as a case in point. The case study collects views not form one or two informants but 21 purposefully sampled participants from three faculties of the institution namely; school of Education, school Humanities and Social Sciences and the school of Health Sciences.

Data were collected using an interview schedule via face-to-face interviews, phone interviews and WhatsApp. The data collection procedures were based on availability and preference of the participants. The benefit of using interview Schedules lies in their ability to enable the researchers to collect the same information from each participant. This enables the researchers to remain focused and in control of the interview (Chingara et al., 2021; McNamara, 2009; Turner, 2010).

Data is presented in tables, figures and by highlighting verbatim responses from the participants. Thematic analysis has been employed to analyze the data sets. Thematic analysis is a method for analyzing qualitative data that entails searching across a data set to identify, analyze, and report repeated patterns (Braun & Clarke, 2006). It is a method for describing data, but it also involves interpretation in the processes of selecting codes and constructing themes (Kiger & Varpio, 2020). Thematic analysis is an appropriate and powerful method to use when seeking to understand a set of experiences, thoughts, or behaviors across a data set (Braun & Clarke, 2012) Using the six step recursive thematic analysis (familiarizing with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and then producing the manuscript) proposed by (Clarke & Braun, 2017), the researchers generated the following themes; Online instructional resources available for lecturers in an EdTech low resource Environment, Lecturers level of usage of online instructional resources across the curriculum Lecturers' perceptions and experiences towards online instructional resources and Strategies lecturers use to mitigate challenges of online instructional resources.

2 Results

2.1 What online instructional resources are available for lecturers?

Two years into the COVID-19 pandemic, Lecturers in higher learning institutions in Zambia have continued to teach online alongside the onsite classes. At the University of Zambia, blended learning which until 2020 was "business unusual" has now become the "new normal". Lecturers combine onsite teaching and online teaching. When asked what online teaching devices and resources they use, lecturers listed devices shown in Table 1.

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Table 1. Most Common Online Teaching Tools used by Lecturers

Online Teaching Tools	*Number of Participants who use them (out of 21)*
Institutional desktop	0
Institutional Laptop	0
Personal Laptop	21
Phone	21

The results in Table 1. Demonstrate two things, firstly that the Lectures do not use the institutionally provided devices to conduct lessons, and secondly, that they use their personal devices for classes to be conducted. Lecturers indicated reasons for not using the institutional devices for teaching as shown in Table 2.

Table 2. Verbatim Responses for use of Institutional Devices versus Personal Devices to teach.

Open Question	*Verbatim Responses*
Do you use institutional devices and the internet to deliver online classes?	• *Many of us teaching staff have never been empowered with even a desktop computer in our offices or laptops. So, we use what we have. What we have is based on what we can afford so the ability to access or use the online tools effectively is dependent on what gadgets we have access to.* • *UNZA internet is usually not reliable for delivering online classes so I use my personal internet.* • *I use my laptop and my internet I haven't been given any institutional devices to use.* • *No, I use my laptop only my desktop is not updated it's an old model.* • *I used my phone and my laptop to teach because the university hasn't provided me with the necessary devices to teach online* • *I use my personal resources to deliver online classes at UNZA because the university management has not given us incentives and proper devices to deliver online classes even though it is expected that we teach online* • *My laptop has been the most convenient gadget. I once used the phone as well. The institutional computers don't work. Most are outdated and some damaged. They haven't been replaced in the longest time.* • *I use my phone for a hotspot when institutional internet fails and my laptop for projecting and teaching.*

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From the results in Table 2, it is clear that the lecturers have continued to use personal laptops, phones and internet connectivity to deliver the lessons online. The University management has not provided ICT infrastructure to support lecturers during online instruction. Also, results reveal that institutional internet connectivity is erratic and usually unreliable. The participants were also asked to state what online platforms they use to deliver the lessons. Responses have been summarized in Table 3.

Table 3. Most Common Online teaching software used by Lecturers

Open Question	***Summary of Responses***
What online software tools do you use to deliver lessons?	• **Zoom Sessions** ➢ Used for synchronous classes • **Google Meet** ➢ Used for synchronous classes • **Moodle** ➢ Used to post course notes, assignments and tests • **Astria** ➢ Used to post course materials for Distance education students and post graduate students • **WhatsApp** ➢ Used for course announcements ➢ To teach small classes of up to 8 ➢ Post course material

In summary, when asked what online instructional resources are available at their disposal since transition to online instruction due to the COVID-19 pandemic and now to blended learning, the participants indicated that they use personal laptops, phones and buy broadband to deliver online classes successfully. The participants indicated that the use of personal devices and resources is not by design but because the university management has not provided the needed resources. Results also reveal that the online platforms used are Zoom, Google Meet, Moodle and WhatsApp, as well as Astria Learning in the case of distance education students and postgraduate students.

2.2. How do lecturers describe the level of usage of online instructional resources across the curriculum?

The participants indicated that they use Zoom sessions and Google Meet for real time classes. Moodle is used to post course content, and give assignments and tests in some cases. As for WhatsApp, the participants indicated that they use it for delivering course announcements. Some participants indicated that apart from posting announcements on WhatsApp since it's the most accessible for all students, course notes and assignments are also given via the platform. Astria Learning, which is only available for distance education students and post-graduate students, is also used to share course materials and assignments. The synchronous online classes whether offered to full-time students or distance students are done using Zoom sessions and

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Google Meet. Some verbatim responses to the question pertaining to level of usage of online instructional resources across the curriculum are as follows:

Participant X indicated that; *I use Zoom because it's convenient for most students. They find it easy to download the recordings. I also uploaded a few materials on Moodle. But when you look at the interaction of students with materials on Moodle it is very minimal. Some students don't even access their materials on Moodle. So, I use WhatsApp for sharing documents. Like slides and handouts.*

Participant Y stated that; *I use Google Meet provided through the UNZA email service. It has unlimited time and you can easily upload the video link on other platforms such as WhatsApp, Moodle or Astria.*

Participant K said that*, Zoom has been helpful to teach students online but recordings are difficulty to upload onto a common platform like Moodle or Astria.*

Participant Z indicated that; *I use Zoom, Google Meet and WhatsApp for teaching and posting course materials. Zoom and Google Meet are easy to use so, real time classes are conducted on Zoom and Google Meet; however, one has to use it under a particular domain to save money. In my case, I use the Zoom facilities provided by Confucius institute to save on money. I WhatsApp for instant communication with the students.*

Participant S stated that*; I use Moodle, WhatsApp and Zoom. WhatsApp is used for sharing documents, its fast in terms of sharing information, most students have resorted to use their phones for studying because they can't afford laptops. The use of Zoom and perhaps Google Meet is good. the visual aspect of it is good, I communicate in real time and create a simulated virtual classroom experience*.

Participant W indicated that, *I use Google Meet and I haven't had any problem with using it. I teach online classes from home using my resources thus my online classes are smooth. After teaching in real time I share the recording using Google Drive.*

These responses show that the Zoom and Google Meet are used for teaching real-time classes. Lecturers and students meet in real-time and lectures are delivered. The recordings are shared on the institutionally provided Google Drive, Moodle and also via WhatsApp for students to have access to them. Moodle and Astria are used to post course materials such as slides, handouts, videos, tests and announcements. The finding also shows lecturers are aware that not all students have access to Moodle and Astria and so WhatsApp is also used to share course materials. As an instant messaging system, WhatsApp is perceived to be convenient and affordable for most students.

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2.3. What are lecturers' perceptions and experiences towards online instructional resources?

Lecturers were asked to describe their experience and talk about their perceptions towards online instructional resources they use to deliver online classes. Majority of the respondents indicated that even though they have managed to deliver online classes the experience has been very challenging and catastrophic in some instances (as shown in Table 4). Seven of the participants indicated that their experience has been a mixed bag and only one indicated that it has been easy.

Table 4. Lecturers' perspectives on online instruction since the transition

Open Question	***Summary of responses out of 21 respondents***		
How has been your experience with online teaching since the transition?	Easy	Mixed bag	Challenging
	1	7	13

The lecturers gave reasons for their experiences and perceptions towards the online instructional resources used. Table 5. Shows the summary of responses of the participants.

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Table 5. Lecturers experiences with online instruction two years into the pandemic

Experience with online instructional resources	*Responses*
Easy	• Easy for me as an instructor the challenges are mostly encountered by students. These include a lack of gadgets and finances for internet services to connect to class. • Helps with managing time • Students give views during lessons without disruption • It efficient • It's very convenient • Teaching without the need for physical presence
Mixed bag	• It been exciting making the transition • The crash course helped but wasn't followed up with other sessions of training. • Training is dependent on better exposed colleagues and self-taught. • The university internet is unreliable but the personal internet works despite being expensive. • Never empowered with gadgets provided by the institution but the personal gadgets did the job.
Challenging	• Students from rural areas had challenges with internet connectivity. In my class of 90 students, only 19 were able to connect. • Teaching using own data is demotivating. • Limited financial resources • Limited knowledge of use of online platforms such as Moodle and Astria • Not knowledge in terms of pedagogy and methods of teaching online. • Challenging to keep students engaged • Students participation is low.

An issue that emerged as lecturers described their experience and perception towards online instructional resources are the advantages and disadvantages of each resource they used. The lecturers commented on the advantages and disadvantages of Zoom, Google Meet, Moodle, Astria and WhatsApp. Table 6. below summaries the responses.

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Table 6. Advantages and disadvantages of using Zoom and Google Meet

Online teaching platform	*Advantages*	*Disadvantages*
Zoom	• Synchronous classes. • Classes can be recorded and shared with students • All students can have access without having an account. • Variety of learning styles • Efficient • Accessibility of time/ space	• The institution does not for subscriptions. • Free session only lasts 40 minutes • Some students don't reconnect after the free session elapses. • Expensive
Google Meet	• Synchronous classes • Classes can be recorded • Affordable • Free it has no time limit • Variety of learning styles • Efficient • Accessibility of time/ space • Free plan allows up to 250 participants	• Only Lecturers and students with Gmail have access.
Moodle	• Convenient for posting course material • Convenient for giving tests	• Some features are not user friendly. • The institutional network did not work well with this platform • Most students are inactive on Moodle
Astria	• Convenient for posting course material • Convenient for giving tests	• Only used by distance students and post graduate students. It not available for regular students at UNZA
WhatsApp	• Easily accessible to students of different economic status • Appropriate for simple discussions	• Video conferencing only limited to 8 people • Not appropriate for complex discussions • Managing the chats can be challenging.

On experiences and perceptions of lecturers towards the use of online instructional resources, results demonstrate that for the most part the experience has been challenging. However, despite the challenges lecturers have continued to deliver lessons online using available and most afford means to them and the students.

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2.4 What strategies do lecturers use to mitigate challenges of online instructional resources?

The findings show that despite the challenges of online teaching, lecturers have managed to conduct online classes and continue to do so in an EdTech low-resource environments. The main strategies used to mitigate challenges of online instruction can be categories into the following groupings; Lecturer-oriented strategies, Lesson-oriented strategies, resource-oriented strategies and student-oriented strategies. These strategies are not mutually exclusive thus should be considered holistically. These strategies are summarized in Figure 1.

Figure 1. Strategies lecturers use to mitigate online teaching challenges.

Lecturer Oriented	Lesson Oriented	Resource Oriented	Student Oriented
• Self-driven training • Engage colleagues who are better exposed in EdTech to help when stack • Sacrificing personal resources • Understanding socia-economic status of students	• Design online suitable content and activities • Dedicate time to prepare lessons (Effective planning) • Recursive varried lessons • Blended learning	• Use of phones and laptops • Use of open educational resources • Using what works in the moment, Zoom, Google Meet, WhatsApp or Moodle.	• Constantly check on students' (enhanced interaction) involvement in class activities • Prompt students to participate in online discussions by leading the discussion • Encourage students in rural areas to attend class from hotspot locations e.g. on a hill.

To sum up, the main components that have been identified as factors that support online instruction during the COVID-19 pandemic and perhaps beyond in an EdTech-challenged environment are highlighted in Figure 2.

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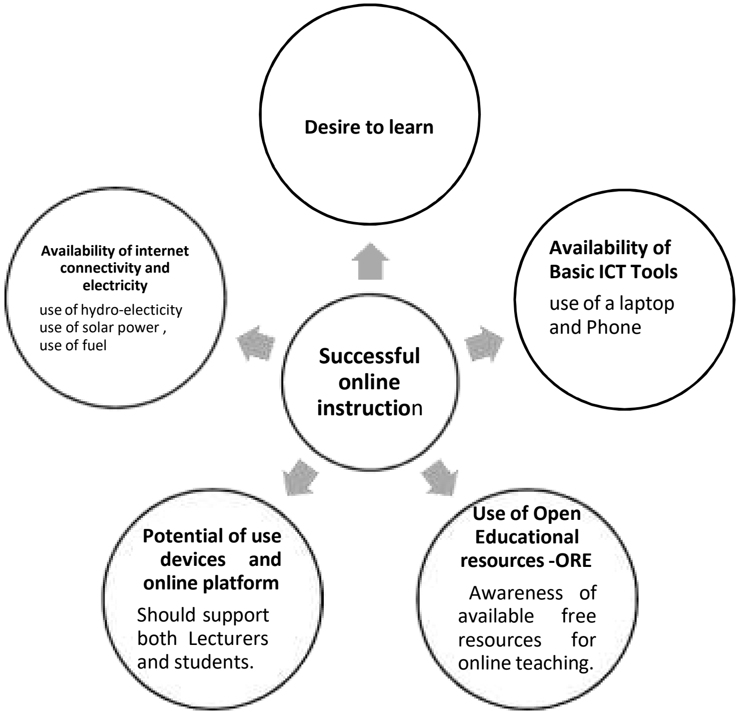
Figure 2. Main components that support online instruction in an EdTech-challenged environment



Findings demonstrate that for an online lesson to be successful even in an EdTech low-resource environment the following basics should be available; the lecturers desire to learn. Learning should be self-driven. The lecturer should possess at least a laptop and a smart mobile phone whether personal or provided by the institution. Lecturer should be aware of open educational resources at their disposal, the ICT tools should be user friendly for lecturers and students. Finally, there should be internet connectivity and electricity (hydro-electricity, solar or fuel).

3.0 Discussion

The current paper intended to study the Strategies used to teach online in an EdTech low Resource Environment During COVID-19. While keeping the minimalist theoretical perspective at the base, the researchers provide strategies the lecturers in EdTech low-resources environments use to teach online classes via available and affordable ICTs. The qualitative case study identified the most preferred ICT devices used by both lecturers and students, the preferred online platforms used to teach online, and finally the strategies used to mitigate challenges faced when engaging with the different available ICT tools and online teaching platforms. The study casts new insights on online teaching during the COVID-19 pandemic using perspectives from the global south.

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3.1. Online instructional resources available for lecturers in an EdTech low-resource Environment.

This study has revealed that the most available online instructional tools for lecturers in an EdTech low resource environment are laptops and phones. This study confirms findings by Nyemba (2020) that indicate that in Zambia the general ICT uptake can be looked at from the use of mobile phones, computers, televisions and radios. These are the most accessible and affordable for both lecturers and students. Yonazi et al. (2012) suggests that it is important first to harness devices that teachers and learners already own. The proliferation of smart mobile phones has meant that more learners have access to ICT devices than ever before, offering opportunities in terms of sustainability and scalability. This way more students are enabled to join online classes successful.

Therefore, via laptops and mostly mobile phones for students, lecturers and students remain stay in touch. When commenting on students use of phones at UNZA one participant had this to say, "*most of the students because of the same challenges relating to them not having laptops and computers have resorted to them using mostly their phones for studying which is a very interesting experience amongst them because you have half the time students staring at their phones and really they are studying because that's the only way for some of them can access easily the course content"*. Chingara et al. (2021) in a study conducted in Zimbabwe on "*e - learning during COVID-19 – perspectives of academics in a crisis"* states that phones are a basic tool for both students and lecturers to stay in touch and perhaps engage meaningfully during online lessons. On the other hand, Minimalists contend that online teaching and learning should only provide that which is significant and has demonstrable benefits to students. In addition, minimalists claim that a limited amount of online resources has the potential to foster creativity amongst lecturers and students (Chingara et al., 2021; Wolverton & Hollier, 2019). Thus, the lack of abundant EdTech resources enhances the creativity of both lectures and students and the learn to make do with what is available.

The use of ICT tools like laptops and phones is an imperative in today's world as the COVID-19 pandemic has taught us. However, one persistent challenge for educational policymakers and planners related to the potential use of informational and communication technologies (ICTs) in low income communities is that most products, services, usage models, expertise, and research related to ICT use in education come from high-income contexts and environments. As such, studies conducted in EdTech low resource environments are useful to help guide the planning and implementation of educational technology initiatives in such environments (Trucano, 2014). Also, the increasing rollout of competitive fibre to Africa and within African countries and greater penetration of wireless and mobile platforms have expanded opportunities for connectivity and broadband access enabling lecturers and students in rural and urban areas to be in touch via online classes.

The present study further casts light on the platforms that lecturers use to teach in an EdTech low resource environment. The platforms identified include the free version Zoom for most participants, Google Meet, WhatsApp, and Moodle. The platforms used have a commonality that of being open educational resources (OER).

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OER is a relatively new concept used pragmatically. The use of OER could be visualized as a part of a larger trend towards openness in higher education including more well-known and established movements such as Open Source Software (OSS) and Open Access (Kumar et al., 2021). According to the Public Library of Science (PLoS), digital resources are open if everyone gains free, permanent, and immediate access to them via a public online repository (Downes, 2007). Open often means that people can reuse and distribute the resources without any restriction as long as they give credit to the original author (Konkol et al., 2021). The widespread use of open resources such as free Zoom and Google Meet

is because that's what is available and affordable in the circumstance. Trucano (2014) argues that the best technology is the one you already have, know how to use, and can afford. While Forgette (2020) elucidates that teachers generally find OER to be flexible, can easily be used for student engagement in the classroom and are a good supplement to traditional existing curriculum. In EdTech low resource environments, the most prominent OER used for teaching and learning due to their ease of use are platforms like free Zoom sessions, Google Meet and WhatsApp. There are several other OER that lecturers could harness to enhance their teaching experience such as Microsoft Teams (Pal & Vanijja, 2020).

3.2. Lecturers level of usage of online instructional resources across the curriculum

The COVID-19 pandemic has significantly changed the education system around the world from the traditional in class lessons to blended learning. It has been found that two stakeholders, particularly lecturers and students work in tandem to experience and utilize online teaching and learning resources successfully. To be relevant and competitive, universities and colleges through initiatives of lecturers have implemented various technologically based platforms to replace the physical classrooms during these times of the pandemic. At UNZA, these platforms include free Zoom sessions, Google Meet, WhatsApp and Moodle. This research shows that the free Zoom sessions and Google Meet are used for synchronous lessons while Moodle and WhatsApp are used to post and share course material including assignments and tests. Lecturers uploaded readable lecture handouts, and others gave full reference books, for reading. Others shared video links and videos using these platforms. The results show that, the platforms have been operative in delivering lessons and sharing course material. Because students found these platforms user friendly, lecturers tend to use them more. A similar study conducted by Al-Maroof et al. (2021) states that online platform such as Google Meet, has been highly evaluated as useful due to the fact that it is easy to use. The interpretation that could be made on this finding is that both lecturers and students gravitate towards the use of platforms they perceive easy one that has features that are user friendly.

A participant in the current study indicated that, *I like to use Google Meet for teaching, tutorials and discussion because once am done with the lessons, I can save the recordings on Google Drive which students can easily access.* Results of the current study confirm findings from other studies on the level of usage of online platforms like Zoom, Google Meet and Moodle. For example Eman (2021) shows that in a technologically developing university in Pakistan lecturers were delivering

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lessons through Zoom. The university teachers were also trained to upload course material online, conduct assessments, evaluations, invigilation, and prepare and submit online results. The entire process was very convenient, fast, timesaving, and hassle free. It was easy to organize things online using these platforms. As a time-suited gap mechanism for meeting the demands under COVID-19 pandemic, online teaching has been implemented as a viable alternative well within its limits and limitations (Mishra et al., 2020). Albeit its limitations lecturers unanimously agreed that their desire to make online classes happen and the efforts of better vested colleagues in technological innovations in teaching enabled them to teach via, Zoom, Google Meet, Moodle and WhatsApp.

3.3. Lecturers' perceptions and experiences towards online instructional resources?

This research brings to light the fact that lecturers' perceptions and experience towards online instructional resources is a mixed bag. The results show that on one hand, lecturers experience with the use of Zoom, Google Meet, WhatsApp and Moodle has been a learning curve and that most lecturers can now comfortably use these platforms and deliver successful lessons. The higher perception of usability leads to the adoption of the online platform during the COVID-19 period (Al-Maroof et al., 2021). Due to the value attached to these platforms, most lecturers have accepted them as their go to platforms to conductor lessons. Similarly, it has been proven that acceptance of technology has a close relation with the perceived value to its benefits especially the technical usefulness and enjoyment (Al-Maroof et al., 2021; Eman, 2021). To confirm these assertions, Bekelea (2021) argues that if students and faculty have dependable access to an ample variety of technologies and internet connections, then that should have a favorable impact in the how, when, where, and even what of learning.

The challenges relate to the fact that firstly, lecturers sacrifice their resources to deliver lessons, students' failure to join lessons due to inability to buy mobile broadband data and lack of institutional support to financially support lecturers to buy ICT tools and internet access. The foregoing findings are in line with previous studies that were conducted in the early days of pandemic (Lufungulo et al., 2021; Mwila K et al., 2021; Rapanta et al., 2020). Notwithstanding the challenges, substantial development of Internet infrastructure and connectivity, institutional support for both lectures and students and wiliness to harness available open educational resource can play a decisive role in improving and sustaining online instruction in African universities (Bekelea, 2021; Chingara et al., 2021; Kumar et al., 2021). That the world over including the African Union, its member countries and universities consider technologies as one of the strategic pillars for catalyzing significant institutional and societal transformations seem promising (Bekelea, 2021).

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3.4. Strategies lecturers use to mitigate challenges of online instructional resources

The study has shown that the challenges of online teaching and use of online tools and resources can be mitigated from four different fronts. These strategies are lecturer oriented, lesson oriented, resources oriented and student oriented. So, for an online lesson to take off in an EdTech low resource environment the lecturers should mutually consider these strategies. To mitigate the challenge of training glitches, rather than waiting on the institutions to organize training, lecturers have resorted to self-driven training and also engagement of colleagues that are better exposed in EdTech knowledge. This way lecturers overcome challenges and difficulties they encounter with the online tools and resources without having to wait for the institution to organize trainings.

A previous similar study conducted by Wang et al. (2021) considered the question does culture or self-directed learning amongst students drive online performance? Findings established that self-directed learning-SDL abilities predict learning performance (Khiat, 2017). The commonly understood concept of SDL incorporates several key skills. For instance, the leaner needs to choose learning materials, set learning goals and rank them in order of priority, assess their own progress and achievements, cope with challenges and practice self-discipline (Ambrose et al., 2010). Similarly, the current study shows that lecturers have had to decide on what online tools and resources to use, set knowledge goals and over the two years of the pandemic have assessed their progress and learnt to cope with the challenges online instructions comes with.

Besides dedicating time to self-driven learning of the online tools and resources, the study also establishes that lecturers have used personal resources to conduct online lessons and have also been understanding of the various social economic circumstances of their students. Without using their personal resources to teach, online learning would have been more catastrophic than it currently is. Several studies have shown that in African universities use of own gadgets and internet broadband amongst academic has been the order of the day. du Plessis et al. (2022) states that institutions of learning were compelled to identify and implement various strategies that contributed to sustaining the academic project and these included but were not limited to engaging in emergency remote learning and teaching, working from home arrangements for staff and finding alternative ways to support students.

This study has further established that other strategies pertain to lesson preparation and presentation, the resources used and the student's welfare. Lecturers indicated that among other issues they are steadily learning to design online suitable content and activities, they engage in effective lesson planning and use blended learning. Online education is not just oral presentation of the faculty on the computer/laptop/mobile phone or it's not just listening at the other end by a student (Naik et al., 2021) it requires effective designing and preparation of the lessons by the lecturers even in an EdTech low resource environment. Online tutors need three things to succeed and reach greater levels of expertise: preparation, discipline and procedural coherence (Cuesta, 2010). In terms of available resources, the study confirms findings by Naik et al. (2021) that the secret to success in the online

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teaching learning process is that the system has to be accessible for both students and staff.

Finally, this study casts light on the main issues that lecturers in an EdTech low resource environment should consider in order to conduct online lesson as indicated in figure 2. The lecturers should have the desire to learn the ropes of online instruction, for a lesson to take off both lecturers and students should have basic devices like laptops and phones. The lecturers should be knowledgeable of open educational resources available and harness them to enhance their teaching experience.

3.5. A question of transferability

Considering all the findings, it becomes important to reflect on the generalizability of these findings or how transferable they are in relation to other education technology (EdTech) low resource environments. The findings of the study, though focused on Zambia, do rather easily reflect the situation and experience of other countries with similar characteristics. From the lack of access to institutionally sources equipment and the concomitant lack of technical support, to the internet access challenges, other resource poor countries are likely to show similar findings because of these shared challenges. The Zambian case presented in this paper is a mere indication of the many digital and learning inequalities that are prevalent in many countries in the Global South. While the benefits of EdTech are significant, they are less appreciated in places where the digital divide is far reaching and structurally entrenched. However, it must be acknowledged that different countries have their own idiosyncrasies that would make this debate and overall experience more complex and nuanced. Sadly, as Beaunoyer et al. (2020) have observed, the COVID-19 has exacerbated an escalation in digital inequalities even more.

4.0 Conclusion

Technology oriented teaching and learning is here to stay. Despite its challenges, it offers a safe haven in the time of crisis such as the COVID-19 pandemic. The study has established that lecturers in EdTech low-resource environment are fully aware of the possible challenges online instructions offers. The study has also demonstrated that lecturers have devised coping strategies that enable them to teach amidst the struggles of online teaching. The strategies are lecturer oriented, lesson oriented, resource-oriented and student oriented. These strategies are not mutually exclusive thus should be dealt as such. Using these strategies helps mitigate the challenges of online teaching and learning and further enables learning to place. According to Yonazi et al. (2012) the future development of Africa and its participation in the knowledge society will be greatly influenced by how Africa manages to deliver quality education to its citizens. The importance of this study is that it offers solutions on how higher learning institutions can cope and successfully offer an online lesson in the midst of challenges therefore, continuing with the education agenda with little or no disruption in the midst of a crisis such as the COVID-19 pandemic.

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The study recommends that universities should continually provide institutional-based trainings to lecturers on emerging developments in EdTech so as to ensure effective and quality of university education for the students. Further, higher learning institutions must equitably provide the necessary EdTech devices, software and other tools to lecturers in order to enhance the online teaching experience. Where possible, external support – such as import duty exemptions or corporate sponsorships and donations - should be sought to enable universities and colleges facilitate learning. For further research, the study recommends an examination of lecturers' awareness and use of various open educational resources apart from Zoom, Google Meet, WhatsApp and Moodle.

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