

Model for Online Teaching and Learning in Zimbabwe Higher Education

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ABSTRACT

This research sought to create a model for online teaching and learning in Zimbabwe higher education, having realised the haphazard manner in which online teaching and learning was being conducted in the said institutions. This was done through determination of the requirements for this endeavour and then using such to design a model. Comprehensive review of related literature was conducted, which resulted in the creation of a conceptual framework. The research followed the pragmatism research philosophy, backed by a mixed method research choice in which questionnaires and interviews were used as research instruments. A case study research design was adopted, with a population of 22000 students and 2240 lecturers. These were sampled at 1% of students and 5% of lecturers. Cluster sampling was used to split the groups, while stratified sampling was used in each group. The major findings of this study were that both lecturers and students require laptops and smartphones as key gadgets for OTL, the internet was also identified as a key infrastructural requirement for OTL success, ICT technical skills and online pedagogical skills are two key skills required especially by lecturers for them to be effective on the online space, and the challenges for OTL were mainly lack of gadgets, slow internet, power challenges, and skills gap. Key recommendations were for universities to come up with schemes to assist lecturers and students to acquire gadgets, continuous ICT skills upgrading for lecturers, online pedagogical skills training and provision of mitigatory measures to handle challenges to online teaching and learning.

Keywords: Online, teaching, learning, ICT skills, ICT infrastructure, challenges to online teaching and learning, higher education.

BACKGROUND

COVID-19, a disease caused by the Corona Virus was first discovered late in the year 2019 in Wuhan, Hubei Province, China (World Health Organization (WHO), 2020). Since then, the disease started spreading rapidly across the globe and found itself in Africa and specifically in Zimbabwe in the early months of 2020. The Zimbabwe government, like any other government in the world had to put in place strategic measures to curb the spread of the disease (Ministry of Health and Child Care Zimbabwe (MoHCC), 2020). To this end, on Tuesday 24 March 2020, the Zimbabwe government closed all educational institutions, key among them – Higher Education Institutions (HEIs), thereby depriving students of learning and growth opportunities (United Nations Educational, Scientific and cultural Organization (UNESCO), 2020; MoHCC, 2020). The nation embarked on its first 21 day long national lockdown, starting from the 30th of March 2020. As the days progressed during the lockdown, it was noted that locally and globally the disease was not slowing

down. The number of infections and deaths from the disease continued to surge (WHO, 2020). Zimbabwe HEIs, like their global counterparts had to make decisions on how teaching and learning could continue during this pandemic.

The institutions abruptly decided to move to online teaching and learning. There was no time for planning, procurement and installation of requisite infrastructure and training of faculty. It was a need to “just get it online”, against the requirements of developing quality online courses. It was an instantaneous shift to “Emergency Remote Teaching (ERT)” (Hodges et al. 2020). While some called it Online teaching and learning, some called theirs Blended teaching and learning, others said it is e-learning, others said it is Virtual learning, while some called it Distance learning and Mobile learning (Adarkwah, 2020; Hodges et al 2020). The sudden move affected the efficacy and eventually the quality of online teaching and learning in these institutions (Adarkwah, 2020). There was no agreed model for introducing the “new normal”. Each institution found their own way in.

STATEMENT OF THE PROBLEM

The Zimbabwe HEIs therefor have a mixed bag of face-to-face, blended and online modes of teaching and learning, however what constitutes the online component with respect to infrastructure and requisite skills is not uniform among the institutions. A wide range of platforms and systems are being used across the nation, depending on what each institution sees fit or can afford. HEIs also face different challenges and barriers to implementing this new normal. They have different levels of investment in this regard and thus the quality of training differs, with bigger institutions investing more and having better quality tuition. However according to the Zimbabwe Council for Higher Education (ZIMCHE) (2019) Minimum Body of Knowledge (MBKs) all HEIs should train uniform MBKs for same degree programmes. This cannot be achieved with a varied online teaching and learning models. The nation HEIs therefore need a model which clearly states the Infrastructure, Information and Communication Technology (ICT) technical skills, online pedagogical skills and ways of mitigating challenges to this endeavour. This model will go a long way towards standardizing online teaching and learning, at the same time ensuring that same quality of students is produced in Zimbabwe HEIs, as envisaged by ZIMCHE.

RESEARCH OBJECTIVES

The objectives of the research were To: –

- examine the infrastructure required for online teaching and learning in Zimbabwe HEIs
- discover the skills and competences required by lecturers and students for online teaching and learning
- determine ways of mitigating challenges and barriers to online teaching and learning
- synthesize the infrastructure requirements, requisite skills and competences and mitigatory measures into a model
- validate the model and modify it so that it becomes a theoretical framework for online teaching and learning in Zimbabwe HEIs

LITERATURE REVIEW

Empirical studies

ICT infrastructure and devices for OTL

ICTs are viewed as a driver of educational transformation, providing several benefits, including the

extension of quality in Higher Education (HE) (Adarkwah, 2020). It therefore follows that for any educational institution to improve its teaching and learning, it has to invest in relevant ICT hardware and software. The need for ICTs gets even severe when an institution moves from F2F to OTL. Globally, following the COVID-19 pandemic, HEIs supported by their governments and private organizations have taken various decisions and actions to address their ICT infrastructure requirements as they moved online. In Ghana, the ministry of education successfully introduced the “one laptop, one student” policy in which over 70 000 laptops were given to schools. While a number of other policies towards improving access to ICTs by students were not successful, this was a move in the right direction. Between 2003 and 2009 the same government had the ICT for Accelerated Development (ICT4AD) policy which aimed at facilitating ICT integration, utilization and modernization in schools. This initiative went through several reviews over the years in an effort to improve the quality and quantity of ICTs accessible to students for purposes of teaching and learning (Adarkwah, 2020). Similarly, the British Columbia ministry of education integrated ICTs from first grades up to grade twelve in an effort to make their education relevant and engaging to students (Birch and Irvine, 2009).

Kim and Bonk (2006) research participants (27%) predicted increase in the use of Course Management Systems (CMSs) in the following five years, thus promoting more learner management than rich and interactive experiences. Video streaming, online testing and exam tools, learning object libraries, asynchronous discussion tools, video conferencing and synchronous presentations are also digital tools whose usage were predicted to increase. And indeed, these tools have become very popular and useful in today’s OTL environments among global HEIs. Reusable content objects and wireless technologies were also predicted to be the most impactful online delivery technologies. A number of other teaching and learning technologies were predicted as upcoming, like peer-to-peer collaboration, digital libraries, simulations, games, assistive technologies, digital portfolios, eBooks, intelligent agents, tablets PCs, virtual worlds and language support. And indeed, today these are playing a major role in teaching and learning in OTL environments. HEIs should therefore make very important decisions on which technologies or a combination of which ones to take, depending on what their faculty and students can best and effectively utilize.

A study by Kumar and Kumar (2021) emphasized the importance of having a reliable internet connection, a laptop or desktop computer, a webcam, a microphone, and headphones for successful online teaching and learning. Chaudhary et al. (2021) suggest that online teaching requires a Learning Management System (LMS), video conferencing software, and multimedia content authoring tools. Research by Asiri et al (2022) found that mobile devices such as smartphones and tablets can be used to supplement laptops or desktops for online learning. While, according to a report by EDUCAUSE (2020), cloud-based storage platforms, online collaboration tools, and secure messaging systems are essential for facilitating collaborative work and communication between students and teachers. In a study by Lee and others (2021), the authors emphasized the importance of a comfortable online learning environment and recommended the use of comfortable furniture, proper lighting, and noise-cancelling headphones. Overall, the literature suggests that a reliable internet connection, a computer, a webcam, a microphone, and headphones are essential for online teaching and learning. In addition, access to online collaboration tools, multimedia content authoring tools, and a comfortable online learning environment can enhance the quality of the online learning experience.

It is however important to note that it’s not just usage of ICTs that make successful OTL. There is need for systematic integration of these relevant ICTs with ideal pedagogical elements. The linking of pedagogy, technology and learner needs will make the best online learning environment. HEIs need to know the *whether*, *when* and *how* of online leaning and decide on the best online design options. Pedagogical techniques such as Online Collaboration (OC), Case Based learning (CBL) and Problem Based Learning (PBL) are regarded as some of the most preferred online instructional methods for online educators (Tang et al, 2020).

Skills and competences required for OTL

While investments and advancements in ICTs make OTL feasible (Asunka, 2008), there are specific skills and competences which the educators and students must possess in order to make the teaching and learning a reality. ICT skills are one of the key skills and competences required by educators and students. For one to go online they must be able to use the relevant ICTs for that purpose. At basic level one should be able to use a computer and surf the internet, but further skills are necessary for successful online teaching and learning. There several other computer-based and internet-based technologies one must be able to access and effectively utilize. It therefore follows that there is need for ICT skills training/upgrading for faculty and students for them to get started in online teaching and learning. In a study conducted in Tanzania, it was discovered that 63% of teachers who engaged in online teaching lacked skills in creating and using online resources (Adarkwah, 2020), which points to lack if ICT skills.

Luongo (2018) identified competence in online teaching as one of key competences required in an OTL environment. Instructor online teaching skills are important for purposes of facilitation and planning (Kim and Bonk, 2006). There is therefore need for educators to be trained how to teach online. They need to know the pedagogical options available in an online environment and how best they can be utilized. Integration of these pedagogical skills with available ICTs will also make a huge difference. Bingimlas (2009) posits that for there to be successful integration, HEIs must provide ICT resources, provide training in new pedagogical approaches and provision of training courses on how to deal with gadgets and modern technologies. Where there is no training for faculty, they will become skeptical of the new “normal” and thus reject OTL as alien to them (Bacow et al, 2012). HEIs must therefore put in place programmes to foster acceptance of OTL. User-needs analysis must be conducted to ensure that the concerns and requirements of faculty and students are dealt with. While a number of considerations must be weighed, HEIs must not forget the diversity of modern students. Students are no longer grounded by geographic location, they are always moving across cities, nations and continents. HEIs must therefore adapt and find ways of helping these academic nomads (Gargano and Throop, 2017).

One of the biggest dilemmas faced by HEIs that have moved to OTL is bored students who eventually dropout of online courses. Students require a richer and more engaging online learning experience. And this can only come when the teacher has adequate skills and competences required in this environment. OTL therefore needs proper linking of pedagogy, technology and learner needs. Faculty training and support are critical in ensuring quality in HE. For HEIs to produce quality students in OTL environment, there must be smooth instructor transition from F2F, and this can best be achieved through adequate training. Educators must design OTL courses from constructivist principles – Relevant, Interactive, Project based and Collaborative. The courses designed should encourage enquiry and elicit active and critical reflection from students. Globally 23-45% of online instructors use online activities that promote critical and creative thinking, hands-on performances, interactive laboratories, data analysis and scientific simulations (Kim and Bonk, 2006). It is therefore imperative for instructors to have online course design skills, such that when they finally put their content online, it will be student centered and meeting their different learning preferences. HEIs must seriously consider monitory support for their instructors to have the sought after pedagogical and technical competences.

The abrupt move to online teaching and learning by HEIs during the COVID-19 pandemic has become the measure of Institutional agility (Wu, 2020), where those that were flexible enough moved to OTL quicker and easier, while the less agile ones struggled to adjust. However, most HEIs primarily focused on transfer of content to digital world and not specifically online teaching and delivery methods. So, there was no assurance of availability of relevant competences and skills. It became crisis learning (Pace, Pettit and Barker, 2020). HEIs have a responsibility to ensure faculty and students upgrade online curriculum, use new instructional methods and strategies (Torquero, 2020). “Typically planning, preparation and development

time of an online university course is 6-9 months before the course is delivered” (Hodges et al, 2020). The current setup therefore is a result of rushed implementation, with very minimum skills, competences and resources.

Challenges and barriers to OTL

Transition to OTL presents a number of challenges to HEIs, educators and students. Some of these challenges become barriers to online teaching and learning in HE. Arthur-Nyarko and Kariuki (2019) identified lack or inadequate access to ICT resources as one of the key challenges to OTL, since it thrives on availability of ICT facilities. In a survey conducted at a polytechnic in Ghana, lecturers revealed that access to ICT facilities was inadequate, time to access was inadequate and there was also little use of relevant ICT software (Amanortsu, Dzandu and Asabere, 2013). Boni (2018) research on Ghana students and teachers revealed that they lacked efficacy and creativity in using ICTs for teaching and learning. There are also challenges regarding the integration of ICTs in teaching and learning online. In another Ghana study, 67% of teachers indicated that they did not integrate ICTs in their work (Adarkwah, 2020), an indicator of possible inadequate access to ICTs or total unavailability or lack of ICT skills. Other challenges to ICT integration in teaching and learning were identified as lack of internet access, lack of quality teachers, inadequate number of computers, high cost of ICTs and lack of electrical power (Ahmed, 2009).

Students at one HEI come from different geographical locations or may even move to remote areas, while OTL is happening. Because there is uneven distribution of ICTs among different populations, some students may fail to access requisite ICTs from their homes (Lembani et al, 2019). In a survey conducted in Tanzania 68% of teachers indicated they had lack of access to a computer, while 73% indicated that their internet was very slow (Mtebe and Raisamo, 2014). Students who have no prior knowledge of using ICTs bemoan lack of technical support in their online environment (Srichanya, 2014). These challenges frustrate both faculty and students, thereby making OTL impractical or ineffective. HEIs should therefore ensure that such challenges are mitigated through training, provision of requisite resources and prior planning. Having plan ‘B’ for electrical power and internet connectivity would go a long way to ensure online presence.

In some cases, faculty are just hesitant and do not accept the “new normal”. Such cases require motivation techniques to be used so as to encourage the transition. Bean et al (2019) cited slow and unreliable network connections as one of the key barriers to OTL usage. For rural HEIs, lack of computers and internet are the key barriers to the “jump” to online settings (DePaul, 2020; Wains and Mahmood, 2008). The difficulty in internet access and network challenges eventually affects students in their learning outcomes. Globally, HEIs have challenges meeting changing student demographics and “the new kind of student”, which Gargano and Throop (2019) call the “academic nomads”. OTL was found to be effective in digitally advanced countries, because their users have the necessary ICT resources and technical know-how (Adnan and Anwar, 2020). This thus creates the gap between developed and developing countries with regards to OTL success. Most HEIs in developing countries abruptly moved to OTL on account of the COVID-19 pandemic, without proper planning, while those in developed countries have been investing and perfecting their act over the years. It can be argued that most of the challenges and opportunities of OTL in existing literature are from a “normal” situation where there has been gradual investment in ICTs, training of faculty, planning and re-strategizing over a long period of time, synonymous with developed countries. These challenges could be worse and the opportunities maybe non-existent in a developing context, hence the need to study, plan and mitigate the negative effects of these challenges.

Conceptual framework

A wide range of literature sources were reviewed and analysed (detailed under *Empirical studies* above). Their analysis and review brought the idea that for there to be high quality and standardized online teaching and learning (OTL), there are three variables that should be satisfied: Firstly, there has to be adequate

requisite Infrastructure, gadgets and their support from the HEI. This will result in contextual readiness of these institutions. Such infrastructure and gadgets include laptops, smartphones, tablets, software, broadband internet, uninterrupted power supply, Computer network infrastructure, technical and pedagogical support. Secondly faculty should be trained prior to implementation of OTL. This will enable them have the necessary technological and pedagogical skills, competences and content knowledge required in this environment. Thirdly, HEI should have mitigatory measures in place that counter the various challenges that arise when using OTL. Skills upgrading, alternate sources of power, system backups, multiple internet sources and periodic infrastructure upgrades will go a long way ensuring on line presence, thus making OTL a practical endeavour (Saiyard et al, 2020; Scherer et al, 2021)

When all the three are achieved, then Good Online Teaching Practices (GOTP) can be adopted and achieved. GOTP ensures interactivity, monitoring, feedback and learner support in an OTL environment (Saiyard et al, 2020).

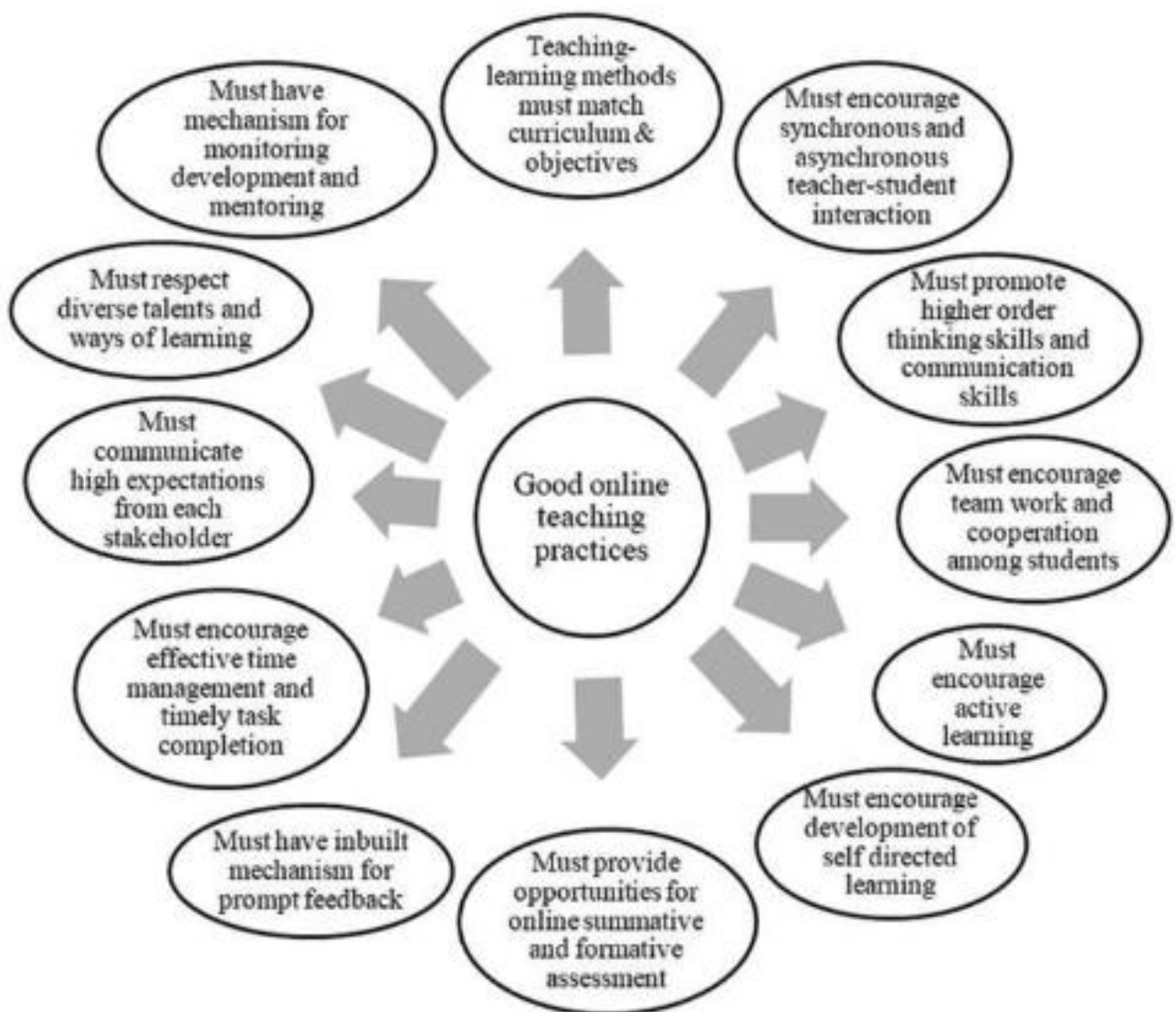


Figure 1: Recommended Good Online Teaching Practices (GOTP)

Source: Saiyard et al, 2020)

Once all HEIs adopt and achieve GOTP then high quality and standard products will be produced. That forms the fundamental model for OTL in Zimbabwe HEI, summarized in the figure below: –

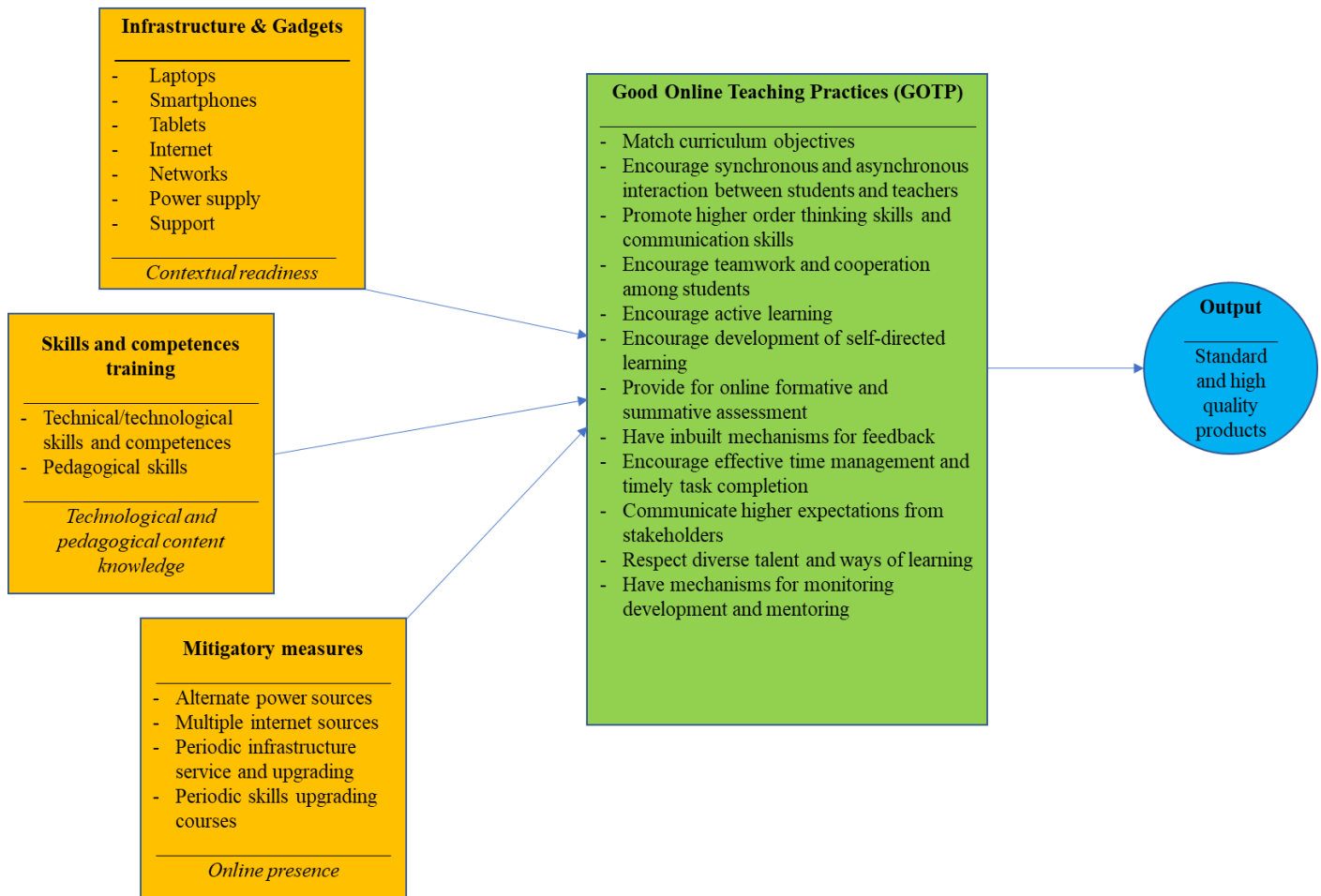


Figure 2: Conceptual framework

Source: Author

METHODOLOGY

Research philosophy

This research followed the pragmatism research philosophy with focus on the practical ways of improving the effectiveness of Online Teaching and Learning (OTL) in Zimbabwe higher education. Pragmatism combines both qualitative and quantitative designs while incorporating the strengths of both positivism and interpretivism in order to comprehend a given situation and thus be able to make generalizations (Willis, 2007). The philosophy enabled the researchers to make operational decisions based on what works best (practical) thereby allowing dynamic and innovative ways of finding solutions to the research questions. The researchers are motivated by the desire to be on the ground, examine the existing infrastructure for OTL, find out the existing and required skills for this method of instructional delivery and determine challenges that are derailing the endeavour together with mitigatory measures. This resulted in the obtaining of both quantitative and qualitative data further justifies the use of pragmatism.

Research approach

This research followed the inductive research approach. In inductive approach the researchers will gather data, analyse them and produce a general level of focus. The research therefore started with a set of observations, followed by seeking patterns in those observations and end with theorizing about those

patterns (DeCarlo, 2012). This approach is consistent with the philosophy since all pragmatic studies move from a complex problem to a general theory of understanding in order to improve a given situation.

Research Design

The Case study research design was used in this study, for both qualitative and quantitative research. The case study involved in-depth study of one chosen HEI, with the aim of generalizing the findings for all HEIs in Zimbabwe. While case studies are ideal mostly for qualitative research, they can also be used in quantitative research (McCombes, 2023). In Zimbabwe, HEIs are run through the ministry of Higher and Tertiary Education, Innovation, Science and Technology Development. The ministry makes policies which are universal for all HEIs making their operations and activities similar. These institutions have similar administrative structure and their standards are controlled and monitored by ZIMCHE. All the institutions adhere and conform to the ministry and ZIMCHE policies and standards. The only difference among the institutions are their size (in terms of enrolment and infrastructure) and programmes offered, which will not affect the outcome of this study. Since the same policies and decisions are used to run these institutions, it can be argued that findings from one of them can be generalized and used as basis to design a model for use by all of them. If ZIMCHE has set the MBKs followed by all HEIs offering same/similar degrees, then one model for OTL would also be possible. The fundamental requirements for OTL in all HEIs are the same, Good online Teaching Practices (GTPs) are universal and hence the choice of case study research design. More so it is expensive and takes more time to use a research design that would involve all the universities in Zimbabwe. Given the time required to complete this project it will become impractical. Taking the case study approach will give basis for further research on the same or similar topics.

Research Instruments

For purposes of this research, this writer decided to use questionnaires and interviews. The questionnaires will be distributed to both students and lecturers from the set categories across the university.

Questionnaires

Questionnaires were chosen for this research because they are a reliable, quick method to collect information from multiple respondents in an efficient and timely manner and an appropriate tool in this era given that COVID-19 is still in our midst and were administered online. The questionnaire is also ideal since there is need to deal with large numbers to achieve precision (Greenfield, 2002; Silverman, 2004; Bell, 2005).

Interviews

Interviews are often used as complementary research method in the social sciences, because they give the prospect for a more in-depth, open discussion, and more informal, free interface between the interviewer and the interviewee (Potter, 2002; Winchester, 1999; Sarantakos, 2013). In this research interviews were used as a secondary method. Despite being considered a disadvantage as it produces subjective results, the flexible format of the interviews have a major advantage for this study, as some nuances of the research such as exploring “emotions”, and “creating memorable experience” may not be properly captured with the questionnaire design. Of course, the results from the interviews are not generalizable, because of the subjectivity of data obtained.

Population and sample sizes

The institution under study has a total 22000 students who attend their various campuses across the country. They also have estimated 2240 lecturers including part timers. Sampling was therefore be done at 1% of

students' population and 5% of staff population. This implies a total of 220 students and 112 lecturers will be sampled for questionnaire administration as the number constitutes 1% of the student population, since the population size was above 10000 and 5% of staff population respectively (Curry (1984) in Yount (2006)). Interviews were conducted with 12 participants from each group, according to the rule of thumb.

Sampling Strategy

For the purposes of this study, the writer examined two separate groups of participants. The first group consisted of students and lecturers from Information Technology department while the other group had the rest of the university since the two groups possess different computer skills. Cluster sampling was used to split the groups while inside each group stratified sampling was used as each group consists of additional subgroups that are the students and lecturers (Kirby et. al, 2000: 339).

Instrument Design

Questionnaires

The writer designed two separate questionnaire scripts, one completed by students and the other one by lecturers. The first part of the questionnaires consisted of demographic questions, related to age, gender. The core questions were divided into two sections for clarity, addressing the sub objectives of the research.

Interviews

The interview scripts for both groups consisted of open questions. The questions for the lecturers were designed to discuss in detail their experience in teaching and learning, skills they have and availability of supportive infrastructure to support online teaching and learning. The questions for the students were designed to reflect their experience as recipients of the service.

Validity and reliability

To ensure validity of interviews, the researchers ensured that questions are clear and easy to understand and use the semi-structured format to reduce interviewer bias (Buffel, McGarry, & Phillipson, 2018). For questionnaires, the research involved pilot testing with a sample of the target population, ensuring that questions are valid and reliable measures of the constructs of interest, and using appropriate response formats to reduce response bias (DeVellis, 2017).

Pilot testing

Pilot-testing interviews and questionnaires involves conducting a trial run of the data collection instruments on a small sample of the target population. This process helps to identify any issues or challenges that may arise with the instruments before they are used on a larger scale. During the pilot testing phase, the questions are reviewed, revised and refined based on feedback from the respondents. The purpose of the pilot test is to ensure that the questions are clear, easy to understand, and relevant to the research objectives (Krosnick & Presser, 2017; Willis, 2017)

For interviews in this research, a small sample of the intended population was invited to participate in a mock interview. The interviewer asked the questions and record the responses. After the mock interview, feedback was gathered from the respondents to identify issues such as ambiguous questions or any difficulty understanding certain terms used. For questionnaires, a small sample of respondents was given the questionnaire to complete. This helped identify issues such as ambiguous questions or any difficulty understanding certain terms used. After completing the questionnaire, respondents gave feedback on their experience, including any suggestions to improve the clarity of the questions. By pilot-testing interviews

and questionnaires, the researchers improved the quality of the data collected and increase the validity of the findings of the study.

Data Collection

Most of the communication with the participants was online. The researchers purposefully targeted lecturers. The interviews were conducted over the phone/Skype depending on the preferences of the participant and will last between 30 to 45 minutes as supported by Collins & Kavanagh (2013). They were recorded and transcribed by the researchers. The interviews were completed within four weeks. The questionnaires were distributed through an online link which gave participants access to the instrument online once they click on the link. This was done for both lecturers and students.

Methods of Data Analysis

The analysis of the questionnaire results was done via statistical analysis (Descriptive statistics) with the help of Statistical Package for Social Sciences (SPSS) software while for interviews it was done through thematic analysis where the author aimed to detect common words, phrases, and group or “cloud” them together, in order to be able to determine trends and tendencies in the answers of the respondents. The results from the questionnaires were presented in the format of tables and charts in order to get more insights from them.

Ethical Considerations

The following considerations were made during the research:

- **Informed consent:** The researchers obtained informed consent from participants before collecting data. Participants were fully informed about the purpose of the study, what their involvement will entail, and any potential risks or benefits.
- **Confidentiality:** The researchers ensured that all data collected is kept confidential and that participants’ identities are protected. This included ensuring that any personal information is kept secure and not shared with anyone who was not involved in the study.
- **Privacy:** Participants have a right to privacy, and the researchers ensured that their privacy is respected throughout the study. This included ensuring that participants are not observed or monitored without their knowledge or consent.
- **Deception:** The researchers avoided deceiving participants whenever possible, as this would undermine trust and compromise the validity of the study.
- **Harm:** The researchers took steps to minimize any potential harm to participants, both physical and psychological.
- **Fairness:** The researchers strived to treat all participants fairly and avoid any biases or discrimination based on factors such as race, gender, religion, or sexual orientation.

Validating the model- Expert reviews

Expert Reviews were used to refine and improve on the model so produced. The reviews also served as a validation tool for the model and making sure that the model will work in reality. The experts were selected from the HEI under study and comprised of ICT and Education experts. The integrative expert review method was used since it allows critiquing and synthesis of obtained knowledge to build a new model, which is the key research output. A total of three (3) experts from each area (ICT and Education) were consulted to review the model so produced.

FINDINGS / RESULTS

ICT infrastructure and devices for Online teaching and learning

Most students as discovered from the questionnaire survey (53%) indicated that they use personal laptops for OTL, while an equal number confirmed to use personal smartphones for the same purpose. Interviews indicated that 80% of students use both laptops and smartphones for online learning while only 20% used smartphones only. Fewer students indicated using university Desktops (26%) and personal tablets (5%). 83% and 90% of lectures from the questionnaire survey and interviews respectively indicated using personal laptops only. The same percentage was obtained from questionnaire survey for personal smartphones while remaining 20% from interviews indicated the use of both personal laptops and smartphones. *“I use both my phone and laptop for online learning, my internet comes through the phone and I then tether it to the laptop which I use for streaming”* said one of the lecturers. These findings reveal that the **Laptop** and **Smartphone** are the two widely and oftenly used gadgets for OTL in the institution understudy for both students and lecturers, however these are personal gadgets. While the university is investing in desktops, they are not being widely used given the requirement that that one has to be at campus in order to use them. This requirement is undesirable given the mobility of modern academics (Gargano and Throop, 2017). The universities therefore should find ways of supporting staff and students in acquiring these popular and ideal gadgets as a way of promoting OTL. *“I think all relevant stakeholders, that is the government through the ministry of Higher and tertiary education and the universities should come up with mechanisms that should help equipping lecturers with necessary gadgets. Even if it means coming up with flexible schemes for buying them these gadgets and let them pay back on relaxed terms will go a long way”* suggested one the lecturers interviewed. Currently the university is not in any way supporting the acquisition of elearning gadgets by both staff and students, this was indicated by 100% of respondents (lecturers) and 68% students. This is idea of supporting the academia was also suggested by Gargano and Throop (2017), who posited that HEIs should adopt and find ways of helping the highly mobile modern day academic, who they termed “Academic Nomads”.

One other interesting finding that came out of both interviews and questionnaires was that the university provides data bundles for lectures so that that can access **internet** outside campus, indicated by 100% of lectures and 100% students though it was said to be insufficient by one of the interviewees who said *“though we appreciate that the university is giving us data, it’s not enough considering the amount work that we are supposed which requires internet connection apart from lecturing”*. This is noble and positive move towards ensuring effective OTL in HEIs in Zimbabwe, given that 50% of lectures use mobile data to access internet outside campus. However, students are not getting any data bundles, despite the fact that 63% of them used mobile data to access internet outside campus. This scenario makes teaching and learning impractical, given that the lecturer may go online or post material online, but the student will not have the requisite data resources to either join a live lecture or access material posted by lecturer. 80% of the interviewed students suggested that the university should include data bundle fees on the fees to be paid by students, engage ISPs for subsidized data costs in order to guarantee lecture attendance by students. 66% of lecturers use live online teaching as a delivery method on the OTL platforms, thereby disadvantaging thousands of students who do not have access to internet, noting that Zimbabwean students come from diverse backgrounds, most of them poor. HEIs should therefore support students with access to internet outside campus. Another way to do this is zero-rating university eLearning platforms so that students are not charged when accessing them. This finding was supported by Memon and Rathore (2018), who identified internet as one of the key tools for teaching and learning in an online environment and thus a great necessity.

On those not using mobile networks, questionnaires indicated that 83% and 58% of lecturers and students respectively find their internet connection outside campus reliable, while 100% those who were interviewed

both students and lecturers who indicated use of non-mobile networks confirmed reliability of their internet connection as echoed by one student who said *“my internet connection is very reliable as I am not using any of these mobile networks”*. It appeared to be a different ball game for students and lecturers who indicated use of mobile networks in connecting to the internet as they indicated that their connection is unstable and unpredictable. *“We are always in and out the lectures due to unstable internet connections, it’s so frustrating”* complained one interviewed student. It can thus be inferred that the issues of internet quality outside campus is not really a key factor affecting OTL if one is not using a mobile network. Neither is the issue of capacity of ISPs. This leaves two key infrastructure issues at play: The Computer and Internet (Memon and Rathore ,2018). These two should be availed and support should be given to Lecturers and students for acquisition of such if OTL is to be effective and uninterrupted.

Skills and competences required for Online teaching and leaning

83% of lecturers surveyed indicated they had computer skills, while 75% said they had Technical online skills and 67% admitting to have Pedagogical online skills. These high percentages were attributed to a two months Online Teaching and Learning course the lecturers went through in mid-2020 in preparation for the full swing online/ blended teaching and learning following the COVID-19 pandemic. This may not be representative of the status for these three skills in all other universities that have not conducted such skills training for their lecturers. Given that 67% of lecturers use Live online teaching in their Online teaching and 79% of students concurred to the same opinion, it is imperative that HEIs in Zimbabwe ensure that they provide adequate training for their lecturers and surveys should be conducted first to determine their training needs as indicated by one the interviewed students who said *“lecturers are key in this setup so more training will make things happen for the benefit of us students”*. 75% of lecturers indicated that online learning is highly affected by lack of training and the same percentage for pedagogical online competences of instructors, while 83% believe technical competence of online instructors play a key role in determining the success or failure of Online teaching and learning. This was supported by 100% of interviewed students who appeared to be worried by the quality-of-service delivery by lecturers so far. One interviewee commented, *“you can even tell that the lecturer has no skill in online teaching imagine a lecturer reading to us notes for period of 4 hours honestly who do you think will be listening to that?”* For students it was 78% for all the three variables. It can thus be inferred that training in both staff and students in relevant and required competences can never be overemphasized.

While in this particular case, 92% of lecturers admit to have been trained on existing university elearning platforms, 48% of students deny training or orientation on such and thus having difficulty time interacting and utilizing such platforms. 33% of lecturers are competent in creating Vodcasts (pre-recorded video lectures), while 41% are competent in creating podcasts (pre-recorded audio lectures). 50% can use live chatting platforms, while 33% can use online forums. The above percentages indicate competence gaps in the use and deployment of the various online teaching methods lecturers ought to use and thus training is therefore a key requisite for successful Online Teaching and Learning.

Challenges and barriers

One of the keys challenges affecting Online teaching and learning in HE is lack of support by university to both students and lecturers in the acquisition of eLearning/ online learning gadgets. This was highlighted by 84% of students and 100% of lecturers including those interviewed. The second challenge is to do lack of internet connectivity or access, especially outside main cities, stated by 78% of students and 75% of lectures. This finding concurs with Adnan and Anwar (2020) and Wains and Mahmood (2008). Electricity or power cuts were also identified as another huge blow to OTL, with 66% lecturers and 68% students indicating so. This finding is consistent with the findings of Adarkwah (2020) and Ivala (2013). Other identified challenges to effective OTL were: lack of gadgets (95% students, 100% lecturers) and cost of internet (95% students, 92% lecturers). The HEIs in Zimbabwe should therefore work around the clock to

mitigate the effects of these challenges, bordering around the availability of gadgets, access to internet and availability of power sources to ensure the gadgets are charged when need arises.

CONCLUSIONS

Based on the research objectives, the following conclusions were made:

a. examine the infrastructure required for online teaching and learning in Zimbabwe HEIs.

The following infrastructure and gadgets were examined and deemed to be key requirements for OTL in HEIs

- Laptops
- Smartphones
- Multiple broadband internet sources
- Data bundles for students
- Power backup facilities

b. discover the Skills and competences required by lecturers and students for online teaching and learning.

The following skills and competences were viewed as required by faculty and students for them to be effective on the online space:

- ICT skills
- Technical online skills
- Online pedagogical skills
- Online content creation skills

c. determine ways of mitigating challenges and barriers to online teaching and learning

The following were identified as ways of mitigating the challenges to OTL:

- University schemes that assist both lecturers and students acquire OTL gadgets
- Zero-rating eLearning websites
- Charging and supplying students with data bundles
- Investing in multiple broadband sources
- Investing in power backup infrastructure
- Providing training to lecturers and students in all requisite skills
- Providing user support

d. synthesize the infrastructure requirements, requisite skills and competences and mitigatory measures into a model.

This was the main objective of the research. Based on the findings on Infrastructure and gadgets requirements, skills and competences requirements and the challenges and methods of mitigating them, the following model was produced:-

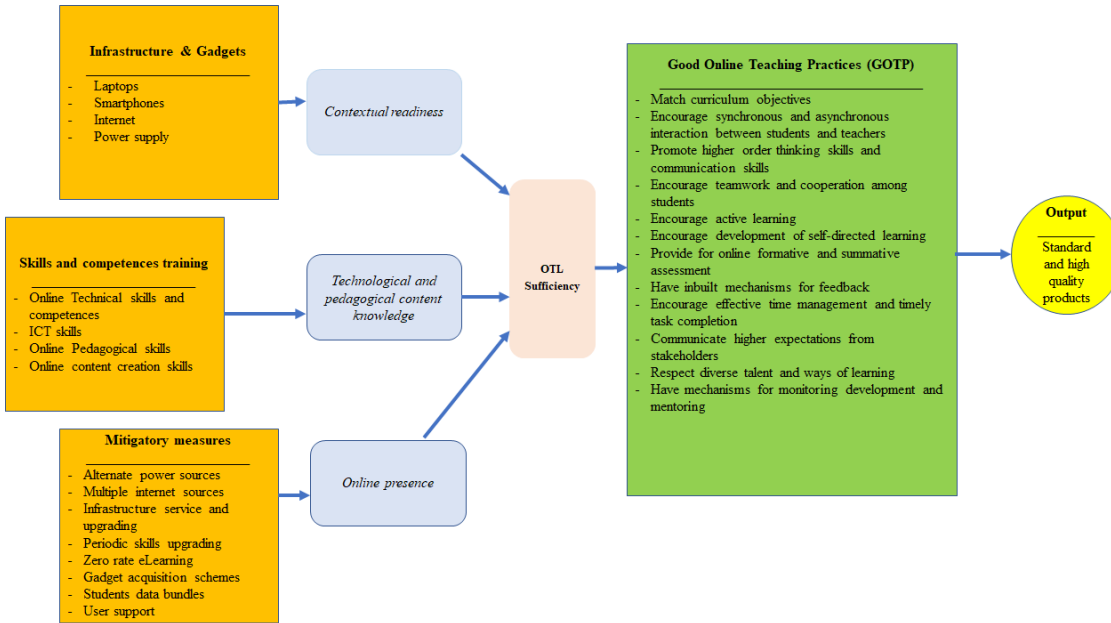


Figure 3: Model for OTL in Zimbabwe Higher education

Source: Author

e. validate the model and modify it so that it becomes a theoretical framework for online teaching and learning in Zimbabwe HEIs.

Following reviews by educational and technological experts, the following was deemed as the final model. However, the model was divided into four stages (1-4) and highlighted that stages 1 and 3 should be reviewed periodically according to university policy for them to remain relevant and consistent with current trends. Stages 2 and 4 should always be checked/measured to ensure that outputs are consistent with university expectations.

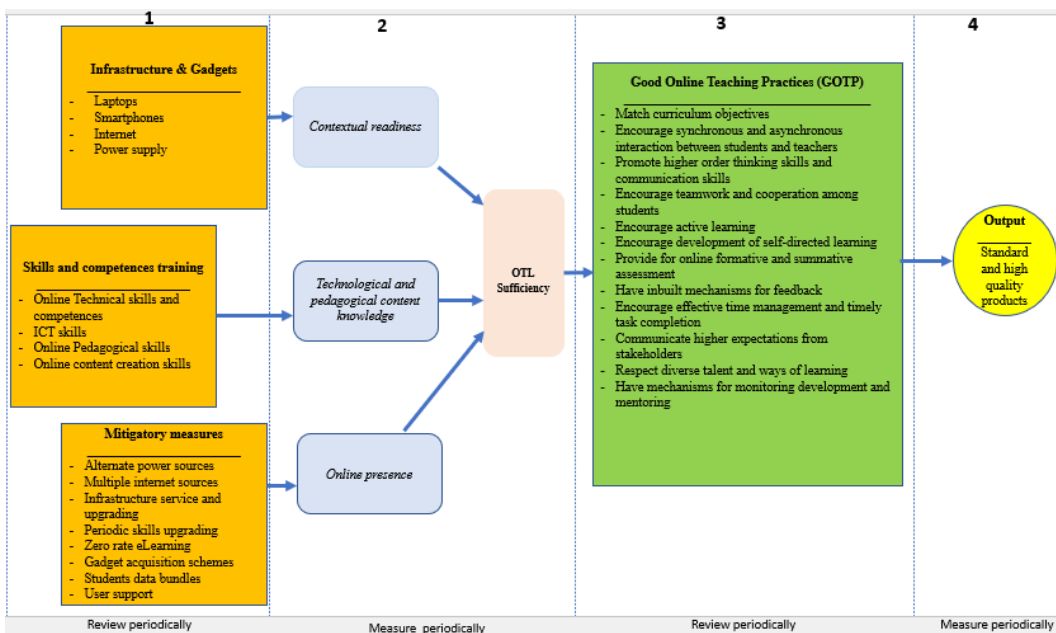


Figure 4: Reviewed model for OTL in Zimbabwe Higher education

Source: Author

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