The Essentials or Fundamentals for Harnessing Technologies to Improve Teaching and Learning through Online Learning as Part of Digital Transformation in Higher Education

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DOI: https://dx.doi.org/10.47772/IJRISS.2024.801183

Received: 29 December 2023; Revised: 12 January 2024; Accepted: 16 January 2024; Published: 23 February 2024

ABSTRACT

The Covid-19 pandemic accelerated digital transformation and usage of the fourth industrial revolution tools in most developing countries where teaching and learning most occurred through face-to-face interaction. To reap successes in the digitally transforming teaching and learning in universities, it is crucial to reconcile the key essential (factors) that need consideration for digital transformation and the challenges hindering the phenomenon. This study explored the fundamental factors for harnessing technologies for teaching and learning in State universities in Zimbabwe. The study employed a desk research approach. The study revealed that tertiary institutions were struggling to effectively implement online learning due to factors such as lack of strategy and vision on the implementation process, lack of financial resources, poor technological infrastructure, poor digital competences among lecturers and students as well as lack of adequate technical support. Instructors in these institutions mostly resorted to asynchronous online learning approaches because they lacked up to date gadgets for synchronous teaching and learning. Similarly, students preferred asynchronous learning due to data challenges as it offered self-pacing and flexibility. In limited cases lecturers make use of WhatsApp, Google Classroom, Google Meet and Zoom. The findings were that in order to institutionalise online learning as key component of digital transformation in state universities the fundamentals to be addressed include of procurement current and compatible IT infrastructure, comprehensive training and education to improve digital competences, incorporate digital transformation and the fourth industrial revolution into university curriculum to equip students, provision of internet data and improved internet connectivity.

Key Words: Universities, Zimbabwe, digital transformation, online learning

INTRODUCTION

The Covid-19 pandemic drastically changed the way numerous organisations approach teaching and learning with various studies having been conducted on these though, there exists a gap in digital transformation studies in education, (Niță & Guțu, 2023). Evidence exists that educational institutions have experienced transformations in their operations through digitalization and the nature of extant social

interactions among colleagues, peers and instructors have also been impacted, (McHaney, 2023; Griffith et al, 2016). The changes experienced were as a result of the heightened utilisations and impact of technology enablement that arose through remote and collaborative work environments that prevailed. The resultant perversions of technology and disruptions brought to the fore the glaring actuality of the fourth industrial revolution and the requisite skills required for digital transformations, (Jimenez-Pitre et al., 2022).

Universities all over the world were affected and the impact was greater for universities in developing countries, (Mpofu & Mpofu, 2023). There is currently a paucity in research that explores how universities assimilated and institutionalized technologies for continued teaching and learning during the Covid-19 pandemic, (Balkin & Sonnevend, 2015). Hence, the primary aim of this study was to investigate the real-world implementation of technology in teaching and learning within higher and tertiary educational institutions with particular focus on state universities in Zimbabwe.

The goal of the student is to provide evidence-based insights that can assist university administrators, policymakers, and other key stakeholders in making well-informed decisions regarding the promotion of digital transformation and the utilization of Fourth Industrial Revolution (4IR) tools in African nations, (Mhlanga, 2020). Digital transformation in education entails incorporating digital technologies across teaching and learning, encompassing the utilization of digital tools and resources to foster captivating and tailored learning encounters, enhance educational accessibility, and cultivate vital skills for the 21st century. Numerous factors, including but not limited to identifying gaps and modelling processes to enhance online learning in a contextualized environment, influence the broader adoption of online learning, (Wang et al., 2023).

LITERATURE REVIEW

The net positive impact of lockdowns enforced by governments throughout the world as a result COVID-19 pandemic on higher and tertiary institutions is noted in the shifting of focus to the use of various methods to implement online learning, (Winter et al, 2021; Vargo et al, 2021; Vahdat, 2022). Studies have shown a significant jump in terms of the implementation figures on some form of online learning features and capabilities in HEI, (Jimenez-Pitre et al., 2022). Similarly, in Africa with the unique dynamics, challenges and structural setup has noted the increase in the number and variety of provisions to enable access to learning resources and institutions. The question, therefore, of which factors are critical to the adequate implementation of online learning is the subject of this study with implementations and models of online learning being presented, together with the unique drivers for online learning to leading to the recommendation of the essential factors to successfully implement online learning in Africa in general, and Zimbabwe and South Africa in particular.

Drivers for digitization in education in Africa

Education in Africa is currently experiencing a myriad of challenges with Evans (2021) highlighting that after conducting a study of over 145 studies from the year 2014, posits that only 1 in 3 children still do not attend primary school. Literacy and numeracy skills are still limited inspite of learners having spent a number of years learning which presents further learning opportunities for all. Similar studies point to poor access to resources, poor infrastructure, and inadequate teaching staff coupled with poor working conditions in addition to the above mentioned challenges to learning. In addition there are the traditional challenges facing the boy and girl child both in the city and in the rural areas such as long distances travelled to academic institutions, home related duties and expectations which are not academically related. Therefore, the study of the current state of the education sector as a whole informs the setup of digital transformation being experienced by the HEI. Some of the major challenges faced in offering digital services which are not primarily limited to education, but also affect industry, business and governmental services are discussed

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue I January 2024

below, (Wang et al, 2023).

Infrastructure

In view of the digital transformation initiatives to attend to challenges in education particularly in HEIs, and in order to attend to these, there are some infrastructural factors that are essential. Current physical spread of centers of learning particularly in rural areas are limiting in terms of reach, thus rendering access to the centres of learning difficult, (DiMaggio & Hargittai, 2001). This is not a problem that is unique to Africa which is normally coupled with the high costs of setting up and staffing the institutions. Digital infrastructure is critical to establishing digitally enabled learning environments, (Sukhdeve, 2021). The difference between physical and digital infrastructure being that digital infrastructure is shared across a network, area or region, whereas for learning centres it is set for the specific centre thus not easily shared. The main digital infrastructure facets that are associated with infrastructural capacity of a nation to aid in digital transformation are viewed against the following aspects as illustrated in Table 1.

There is a need for network coverage to allow connection to the internet as the resources and interactions of instructor and learners are via electronic means and in most cases across distances, (Cabrera-Castellanos, 2021). South Africa has achieved a digital network coverage of 100% whilst Zimbabwe has a 94% network coverage. In addition to this, mobile device ownership, computer availability and broadband access in rural and urban areas is a critical matric to digitization of learning where currently, South Africa ranks higher than Zimbabwe as in Table 1 below.

Table 1: Infrastructure and Access

Country	Factors	Internet use	Network
South Africa	Mobile ownership: 78% Computer at home: 27% Internet home access: 77% Rural access: 62% Urban access: 84%	Use level: 72% Fixed broadband per 100: 3 Active mobile broadband per 100: 135	Network coverage: 100%
Zimbabwe	Mobile ownership: 47% Computer at home: 14% Internet home access: 50% Rural access: 36% Urban access: 74%	Use level: 35% Fixed broadband per 100: 1 Active mobile broadband per 100: 60	Network coverage: 94%

Adopted ITU (2023)

The challenges experienced in delivery of online learning include limited internet connectivity as indicated in Table 1 above that in terms of access to the internet, there are differences between Zimbabwe and South Africa with increasing difference between the rural and urban populations of the 2 nations (78% in South Africa and 62% rural and 84% urban access versus 47% in Zimbabwe and 36% rural access against 74%

urban access), (Statista, 2023). ITU reports that there are still 2.6 billion people who have no access to the internet which is 33% of the global population against 5.6billion people with access to the internet (ITU, 2023). With the continent average of 43% of the African population having access to internet connectivity according to ITU (2023) which is below the global average of 66%. The highest rates were found in Morocco with 88%, South Africa with 72% at 6th in Africa and Zimbabwe at 35% at 28th position according to ITU (2023). Unequal internet access places a further burden and barrier to the availability of internet services thus further hampering the ability to deliver online learning. The building blocks of a robustly connected population is thus lacking in Africa in general and Zimbabwe and South Africa specifically. In addition, cost of access is higher given the opportunity cost for the urban and rural family given the data costs in Africa which hamper access further as discussed below.

Costs

Studies have shown that the costs of access to the internet, costs of devices such as computers, laptops, and smartphones pose the risk of pricing out some members of the population from accessing internet services. The competing needs for finances in most homes creates a barrier to acquisition of these gadgets and resources thus limiting the ability to avail online learning services to the population. The costs are related to provision and access to internet services, development of content and distribution by the instructor and its access by learners, device access, training in digital skills costs money as well. The cost challenge is further exacerbated by the minimal availability of financing options to assist the population to access the said services and devices necessary to facilitate online learning due to multiple factors including learners and at times their parents and guardians being unofficially banked, a myriad of economic challenges and other social-economic factors affect access to funding, (Chowdhury et al, 2023; Chavula et al, 2019; Mathew & Ebelelloanya, 2016; Wright et al, 2009, Wright et al, 2009).

Digital Literacy

A major challenge in Africa is the deployment of inadequately skilled personnel in educational institutions and thus in offering digital skills. As a result, the ability to cascade the same skills further to learners becomes hampered. Digital literacy has been shown to be a major driver in the adoption and use of digital technologies, and thus where it lacks it creates a barrier to effective distribution, use and enjoyment of digital service across the spectrum and similarly in HEI institutions seeking to offer online learning opportunities, (Yaya et al, 2015; Ojimba, 2011; Gann & Senker 1998). Currently, governments are seized with efforts to ensure instructors are adequately trained and resourced with digital skills and work environments in light of studies that have pointed to the specific skill factor as critical in the adequate delivery of services. In a study by Mpofu & Mpofu (2023), the study proved that lack of or a weak base for the instructor in digital literacy hampered the adequate use of online learning among learners. Similarly, learners found the process of learning online challenging where they did not experience adequate training in digital skills prior to embarking on online learning. In addition, the range of digital tools, platforms and services that are available and accessible play a central role in the rate at which digital skills are employed. Knowledge of the skills, the cost of acquisition of the same and the time taken to learn reflected in the learning curve were found to play a key role in the determination of what to use, when and how by the instructors in HEI. Among the prominent providers of the online learning platforms, there were none that were primarily developed by and for the African context specifically, but were customised to be useful in African HEI though developed principally for western and Asian markets. The major factor additionally noted was the language barrier where the tools employed were noted not to be worded to speak to the local scenarios, with uncommon terms and approaches employed which added further complexity to both instructors and learners. African online learning content solutions would be contextual encompassing local language orientation to facilitate easier interaction with the various tools and smoothen the teaching and learning process. Lack of face to face interaction results in limited interactions between instructor and

student which bridges a gap between the two which may consequently seem to dilute the learning process and make the assessment and evaluation process more complex and require training for effective learning to take place, (Hafsari, 2022; Cahyani, 2021; Li, 2021; Halil, 2020).

Policy and regulation

The nature of policy development, update and implementation places a stumbling block to initiatives to expand access to online learning. The diversity policies hinder the expansion of training regimes to ensure the development of a compliant instructor base from colleges and training institutions. In addition, governance policy have a bearing on the creation of a conducive business environment which ultimately affects the delivery of infrastructural and operation environments for internet services and their affordability, (Ujah-Ogbuagu, 2021; Voelsen, 2021; Kyi & Laishram, 2022). For instance, the recent launches of star link offer a unique opportunity for African nations that typically struggle with infrastructure setup for widespread access to the internet due to the cost of fixed connections and laying of cables and the numerous connectivity components to bypass this huddle by securing and satellite based easy to setup and fairly affordable internet link. However, in some countries in Africa, the approval of such a noble initiative offering increased bandwidth is being hampered by red tape in approval policies due to regulators being unfamiliar with the technology in some cases or simply unwilling to allow private players to offer services in the tech space. These opportunities present options but regulatory environments do not allow for the taking advantage of infrastructure setup to allow increased access and use of internet connectivity thus hindering expansion of such offerings. A case in point is the difficulties being faced by Starlink to distribute their services in Zimbabwe due to delayed regulatory approval. Similarly, copyright enforcement or lack of, present complexities on the ability to make online resources adequately available, thus innovation may be supported or hindered by the complexities of protecting or accessing innovations. The current policy frameworks and their enforcement similarly create challenges to content creators as implementation and speedy enforcement is hampered by skills shortage, policy limitations and unwillingness to enforce in some jurisdictions further hampering widespread use of online learning in Africa, (Oughton, 2023; Martin, 2020).

Social and cultural factors

The issues that affect the African context, though changing, still present challenges in the delivery of online learning. Access to resources in some communities is affected by gender issues, with the girl child being relegated to conducting home care duties as per traditional expectations whilst the boy child is provided with more resources to allow smoother learning experiences. The challenges also usually prevent the girl child from being ideal in the eyes of the family by “playing” on the phone or computer or accused to be now searching for mischief, and is expected to take care of the home based on societal role play by the girl child such as fetching water, preparing food, helping with the children and such like. Socially and culturally acceptable behaviours may not be in support of online learning as it may be deemed unacceptable, where the traditional model of learning where one attends class to enjoy face to face learning is more acceptable. Social isolation and lack of interaction with peers may create an unacceptable setup for learners and parents and or guardians which would not be supported. The self-directed learning approach may be a foreign concept which may thus hinder effective use as acceptance may be low with digital fatigue being experienced by learners due to the demands for self-learning. In some cases, issues of cyber bullying, online harassment may exist with dominant characters thus presenting negative sentiments to online learning, (Bekele, 2021; Olasina, 2019; Asunka, 2008; Moyo, 2003).

Security factors

Concerns to do with data privacy and security present another type of challenge to digital transformation which needs to be addressed with the availability tools for collection, storage, and use of sensitive student data in an safe, secure and acceptable manner. The various tools employed to offer online education rely

heavily on data analytics to facilitate the customization of learners' learning experiences. To ensure that the information collected and generated is safe and secure, policies, procedures and tools employed are robust, durable and protected Balancing the need for personalized learning with robust data privacy and security measures is an ongoing challenge which require the development of standardized approaches to be developed but are hampered by diverse learning environments and systems in operation around the world. In addition, there are divergent policies and regulations promulgated by different governments which may thus impede the interoperability of educational technologies and thus result in inconsistencies in the quality of digital resources available to students and educators. There is thus inequality in the setup and digital footprint in efforts for digital transformation, (Ng'ambi et al., 2016; Ohei et al., 2023; Wang et al, 2023)

Role of drivers for digitization in Africa

The above discussion highlights the important factors that have a bearing on the successful digitization of education in Africa and resultantly in Zimbabwe, more so in state universities. The above highlighted factors infrastructure, costs, digital literacy, policy and regulation, social and cultural factors and security factors are essential in ensuring a suitable digitally enabled learning environment. Once focus is placed on these aspects, they largely highlight the influences for successful organisational infusion of various technologies leading to enhanced digital teaching and learning environments more so in state universities. In the next section, online learning as a means for enhanced teaching and learning in a technology enabled environment is discussed.

Online learning

Online learning is associated with distance learning or remote learning is education that instructors deliver instruction to learners who are separated from the instructors and supports the continual interaction and exchange of resources between the involved parties. The exchange, engagement may be synchronous whereby learners and instructors interact in real-time, typically, in the form of live sessions such as zoom, teams, and Google classroom based engagements to allow for live video interaction virtually allowing instructors and learners to interact with each other in instruction and in reinforcing or correcting misunderstandings through question and answer sessions, all in real time, (McBrien, 2009; Wang, & Reeves, 2007).

The other form of online learning is asynchronous learning which functions by providing access to a variety of educational materials with instructors and learners able to perform their role independently of the other. Instructors may pre-record lessons in video or audio format, which may be availed to learners via a learning tool such as Google classroom, Moodle or Sakai whereby the learner is able to complete any provided work such as assignments, or tests at one's own pace.

The model is well suited to self-paced learning scenarios or modules as they provide flexibility to both lecturers and instructors with no need to have synchronised schedules, (Ringler, 2015; Vonderwell et al, 2007). Online learning may be provided via blended learning or hybrid learning models of learning where there is a combination of traditional face-to-face instruction with online learning components, (Power, 2008; Watson, 2008). The model which is successfully employed allows for learning to occur both in real-time and with delayed access or in conjunction with face-to-face interaction.

The model is quite popular in most institutions that offer online learning owing to the support for more personalized and flexible learning experiences. The flipped classroom model reverses the traditional teaching methods with students learning new content online through videos or readings before class and then engage in interactive activities, discussions, or projects during face-to-face sessions, (Jiang et al, 2022; Yildirim, & Kiray, 2016).

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue I January 2024

Online learning may also be delivered via self-directed learning where learners take control of their education and are able to study autonomously by selecting their learning materials and setting their own study pace which determines the learning process. Gamification is also possible, whereby learning is integrated into game elements to enhance engagement and motivation with interactions taking place as one plays the games.

The approach typically depends on online platforms providing game-like features such as points, badges, and leader boards to make learning more interactive and enjoyable, (Duggal et al, 2021; Matsumoto; 2016). The last model of interest is the social learning models which place greater emphasis on the collaboration and interaction amongst learners. The approach relies on the provision of online platforms which facilitate discussion forums, group projects, and collaborative activities, enabling students to learn from each other, (Horsburgh & Ippolito, 2018; Ferguson, & Buckingham, 2012).

Frameworks for digital transformation in education

There are a myriad of frameworks suitable for digital transformation initiatives as depicted in Table 2 below. Accenture proposes the Digital Capability Assessment (DCA) which addresses strategy and leader, people and culture, product and services, customer experience and enterprise enablement. The facets of the model point to the need to be strategic in the transformation initiatives which is led by the leadership within the organisation which addresses the people and cultural setup of the enterprise to ensure that the enterprise positively impacts customer experiences through product and service delivery, (Alenezi, 2021).

Table 2: Frameworks for Digital Transformation

Model	Components	Proponents
Digital Capability Assessment (DCA)	• Strategy and leadership • People and culture • Product and service • Customer experience • Enterprise enablement	Accenture
Digital acceleration index (DAI)	• Business strategy driven by digital • Digitize the core • New digital growth • Enablers	BCG
Digital maturity model (DMM)	• Customer • Strategy • Technology • Operations • Organization and culture	Deloitte

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue I January 2024

Digital readiness assessment	• Strategy, innovation an growth • Customer experience supply chain and operations • Technology • Risk and Cybersecurity • Finance legal and tax	EY

Adapted from (Alenezi, 2021)

The listed models in Table 2 above, illustrates the models developed by EY, Deloitte, BCG and Accenture which have a common thread that includes strategy as a core pillar of the digital transformation initiatives and efforts. The strategic impetus, though bundled with other aspects, reveals the importance of a deliberate concerted and coordinated approach to digital transformation in the enterprise.

Technology and customer experiences point to the importance of customer centric approaches in the digitization efforts reflecting that the initiatives should not lose track of the most affected individuals or groups in the operations of the organisation. All digitization efforts should seek to understand the needs of the customers in relation to the drive to bring technology into the interactions and engagements with customers. The product and the services and the manner in which these are delivered are highlighted in the models depicted above with the operations and cultural efforts.

Table 3: Education digital transformation models

Model	**Components**	**Proponents**
70:20:10	• 70% learn by doing • 20% learning by coaching or mentoring • 10% learning is formal	(Developed Originally By Morgan McCall, Robert W. Eichinger and Michael M. Lombardo) (McCarthy et al., 2023)
TADEO from the Portuguese meaning Drivers for digital transformation in education	• Technical drivers • Organisational drivers • Digital teaching competence • Soft skills student • Hard skill student • Pedagogy	(Oliveira & De Souza, 2021)
Value chain for education	• Pedagogy • Technology • Organisation • Economy	(Godin & Terekhova, 2021)

Adapted from Godin & Terekhova (2021); Oliveira & De Souza (2021)

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue I January 2024

Theoretical framework

The drivers of online learning may be informed by the complementary role of the following four (4) theories to learning.

Behavioural theory argues for the passive learning approach which relies on the social, cultural background of learners whereby the assumption is that the learner appears before society as an empty slate ready to learn by absorption all that they need for life. Early proponents of the theory suggested that learning occurs as a series of reinforcement behaviour for acceptable conduct or behaviour and thus complements with the theory of social learning. The ability therefore to learn in community is well supported by online learning particularly in the digital native generation.

The theory therefore supports the notion that online learning continues on the path that learners have become accustomed to from their backgrounds and are thus able to adapt faster and learn better when provided with mechanisms to learn online. By providing positive reinforcement, like rewards and recognition such as badges or lbonus marks to students who show outstanding improvement, effort, or performance, the theory provides valuable input into the importance of digitizing education. Online learning is thus supported through repeated use of body language and other non-verbal or physical cues which serve to reinforce and manage learner behaviours, (Kasonde et al, 2013; Nagowah & Nagowah, 2009).

The cognitive theory which rose to prominence in the 20th century highlights the active aspect of learning which is not addressed by the above mentioned Behavioural Theory by providing an approach that is focused on the internal thoughts, perception, memory, problem-solving, and decision-making abilities of the learner. The learner is considered to be one who is able to access, breakdown and reconstruct knowledge in an active rather than passive manner. The learner achieves this by maintaining and documenting the learning process for reference and to provide a map to follow going forward. Learners are encouraged to participate in group work class discussion and to link events or concepts to reinforce the learning process, (Rachman, 1998). Online learning allows learners to approach learning using their own unique perspective. The learner is able to formulate a study pattern which may be high or low paced and is able to follow or structure the learning programme as they desire. For instance, a learner may prefer to run through all material first to appreciate the subject matter before beginning to work on individual aspects. Online learning allows for such modes of learning and where individuals look to study at odd hours, and diverse locations, they are well able to as well.

The Constructivist Theory supports online learning by recognising the active role of learners in constructing their own understanding of knowledge and the world around them typically by building on the knowledge they already have acquired. The two views of the approach include cognitive constructivism associated with Jean Piaget and social constructivism with Lev Vygotsky; where the learning is supported from the two dimensions, (Hein, 1991).

The final theory considered in this paper is the humanist learning theory which is learner-centric, heavier emphasis on the learner to allow them to tap into their potential rather than expect the instructor to attend to this role actively is adequately supported by the online learning. Higher learning theories prioritize meeting the unique emotional and academic needs of each learner so that they are empowered to take greater control over their own education, with the instructor providing support, feedback and encouragement as well as motivation to students in view of building confidence and connection to learning material which is similarly supported by online learning, (Javadi & Tahmasbi, 2020); Tangney, 2014; Jingna, 2012).

METHODOLOGY

The desk study on digital transformation in higher education made use of a methodical and inclusive

The desk study on digital transformation in higher education made use of a methodical and inclusive strategy for collecting, analyzing, and consolidating information similar to the approach adopted by Randolph (2019) and Okoli (2015). The research methods encompassed a meticulous examination of existing literature, and academic publications that pertain to digital transformation in higher education.

To gain a comprehensive understanding of the current state of digital transformation in higher education, a thorough review of peer-reviewed academic journals, conference proceedings and pertinent books was conducted. This entailed investigating relevant themes, including technological advancement, challenges, opportunities, and exemplary approaches within the realm of digital transformation in higher education institutions. The collected information was methodically structured, classified, and examined to identify recurring themes, emerging trends and discernible patterns.

To access a diverse array of digital content, the study made use of online platforms, databases, and digital repositories. Through the Google Scholar platform, the search yielded 200 results comprising over 10,000 citations. These results encompassed a broad spectrum of academic databases, institutional websites, and digital libraries that focused on specific case studies related to digital transformation in higher education. By conducting a comparative analysis of various case studies and institutional approaches, the study gained an understanding of the complexities associated with digital transformation in higher education. By conducting a comparative analysis of diverse case studies and institutional approaches, the study attained a comprehensive link to digital transformation in higher education (Knight, 2008).

To guarantee the reliability and validity of the information, a meticulous evaluation of the chosen literature and data sources was carried out. The study implemented quality assurance measures to include reputable and peer-reviewed sources in the analysis, (Stellefson et. al., 2013).

FINDINGS

The digital transformation for digital learning in higher education framework highlights that online course delivery replaces or supplements the traditional approach in face-to-face lectures through use of online course delivery methods. The approach relies on the availability of learning management systems (LMS) such Moodle, Google Classroom and Sakai to provide students with access to course materials, assignments, and various types of content. These may be open source, cloud based or locally hosted by academic institutions.

Through blended learning there is a combination of online and in-person interaction to allow students to engage with educational content through digital platforms while also supporting engagement and interaction in discussions, and practical exercises in physical classrooms.

There are a variety key technical drivers for the enhancement of teaching and learning which are driven by resource availability. The required resources include computer equipment, internet infrastructure in the hands of the learners and the educators in Zimbabwean state universities which is found in some instances but lacking in others. The organisational situations play a critical role in this aspect as some state universities have multiple campuses which require connectivity at these sites whilst yet others have off campus accommodated students who are not usually able to access the institutions internet services off campus. These factors need redress to facilitate the enhanced offering of teaching and learning at state institutions. Human resources capable of supporting learning in such diverse environments are critical to support both the technical needs for the provision of the teaching and learning tools and the digital skills necessary to support the provision and access of lesson material.

There are various strategic aspects driven by the leadership philosophy which affect how the state

universities in Zimbabwe function. There are also people and culture driven effects on the same. In order for effective improvement to be realised in the provision of teaching and learning at the highest level through the use of technology, there is need to develop the right philosophy, attitude and perspective on these to ensure that all works as desired to transform education through technology in state universities in Zimbabwe. In most instances, state universities are led by government appointed principle officers that is vice chancellors, registrars, librarian, and pro-vice chancellors. They thus carry a mandate from government which drives the approach to administration, strategy formulation and resource provision. This area is critical in arriving a positive technology centred drivers for enhanced use of technology in teaching and learning in state universities in Zimbabwe.

Opportunities to provide enhanced teaching and learning may be achieved through the use of various approaches such as the 70% learning by doing, 20% learning by coaching or mentoring and 10% where learning is formal. These approaches may be supported through models similar to Massive Open Online Courses (MOOCs). MOOCs have gained widespread popularity due to the ability to allow for large-scale online courses that may be accessible to anyone with an internet connection. These courses are often provided by prestigious institutions and allow learners to access high-quality educational content from anywhere in the world. In the same perspective, there is personalized learning support to allow for digital learning platforms to use data analytics and algorithms to provide personalized learning experiences. Learners are able to receive tailored recommendations, adaptive assessments, and individualized feedback to enhance their learning journey. The provision of interactive approaches enable learners to access course material through videos, virtual labs, and gamification, making the learning experience more engaging. Various multimedia approaches cater to diverse learning styles and encourage active participation.

Collaborative learning platforms facilitate collaboration among students through discussion fora, group projects, and virtual teamwork. Learners are able to connect with peers from different geographical locations, promoting cross-cultural exchange and diverse perspectives. Digital learning speaks to accessibility of learning through improved access to education by removing geographical barriers to accommodate learners from diverse backgrounds through the ubiquity of technology thus supporting learning at an individual's own pace, access to learning resources throughout the day with various features and provides accessibility features for individuals with disabilities.

Transformation of the learning process in the area of assessment and feedback is supported through the use of digital assessment tools to allow for automated grading to allow for immediate feedback, and data-driven insights into student performance. Such tools thus make it possible for the instructors to be informed and to be able to identify areas of improvement and provide timely support to students.

Online learning supports learning by providing a mechanism through which one may be able to engage in lifelong learning and certifications to allow skills acquisition or evidence of individuals having acquired the specific skills and demonstrate their expertise in a flexible manner. The approach therefore to decision making is data-driven as large volumes of data are generated based on data on student progress, engagement, and performance. Institutions, instructors and learners may thus leverage this data to make informed decisions, improve curriculum design, identify learning gaps, and enhance teaching methodologies.

CONCLUSION

Digital transformation is enhanced in effectiveness through the promotion of digital literacy and skills development by supporting investment in educational programs and initiatives that equip individuals with essential digital skills, these being instructors and educators to enable meaningful participation in the digital economy. Digitally enabled and supported learning depends on the established internet infrastructure which without renders the learning management systems unable to access the service. There is a need to facilitate

and support various options to access the internet by the targeted learners with investors in fibre optic networks, mobile broadband technology, and satellite internet solutions to reach remote areas being critical to supporting digital learning initiatives. The role of government in the deliberate efforts and initiatives to encourage the reduction of the costs of devices and internet access through governments and mobile operators by implementing strategies like subsidies, tax breaks, and innovative financing options to make digital technologies more affordable. Such collaborations ensure that the whole value chain benefits whilst development action is promoted in the educational sphere. Digital transformation in online learning relies heavily on the availability of the relevant localized digital content and services which is applicable to the various needs of the targeted learners and skills levels of the instructors. Governments and academic institutions are able to strengthen policy and regulatory frameworks to promote competition, encourage innovation, and protect users' rights online. The policies may thus incorporate mechanisms to attend to social and cultural barriers as much as is feasible, whilst addressing security and engagement rules to provide sufficient access whilst preserving availed data. The ensuing digital environment ensures digital literacy training among the educators and translate to the training of students in digital literacy skills in addition to domain knowledge and other curricula content. Digital transformation to support online learning encourages the promotion of environmentally sustainable digital development of digital infrastructure and promotes efficient technologies for responsible digital transformation. There is a need for governments to invest in creating ideal work environments to allow for innovation in the creation of African centred online learning tools to support the uniqueness of Africa whilst maximising on the opportunities presented.

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