



Are we leaving students behind? Self-directed learning in an ICT challenged country

Reuben Lembani¹ · Kabwe Mulenga¹ · Peter Mwewa¹ · Lydia Mhango¹ · Nchimunya Chaamwe¹

Received: 19 April 2022 / Accepted: 31 August 2022 / Published online: 23 September 2022

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Abstract

This study investigated the preparedness and experience of students for the fast-paced convergence of ICT and higher education. Overall, 366 distance students with a history of self-directed learning through correspondence courses were profiled using structured text-based online interviews. Twelve students' attributes on ICT material possession and competencies and experience of Open Distance and Open Learning (ODEL) were collected and analysed. The findings show that the majority of students (72%) who had prior knowledge about the basic concepts of ODeL modalities indicated satisfaction with the e-learning environment while the learning mode is challenging for traditional students (28%). Statistically significant positive correlations ($p=0.00$) were observed between ICT competencies or preparedness: the level of prior academic qualifications (HAQ: $r^2=0.35$); key challenge faced (KC: $r^2=0.26$); and the convenience of ODeL (C.ODeL: $r^2=0.18$). To ensure that students are not left behind with the proliferation of ICT in distance education, principal component analysis revealed that having prior knowledge about the ODeL modalities is an important attribute that contributes to students' preparedness for the e-learning environment, thus bridging the variance between the expected expectations and the actual expectations.

Keywords ICT competencies · ODeL · Principal component analysis · Self-directed · Students

1 Introduction

Sub-Saharan Africa is experiencing a noticeable increase in the gross enrolment ratio (GER) in institutions of higher education (HE) from 4.7 in 2004 to 8.59% in 2014 (World Bank, 2014). Population growth and an increase in the citizenry below

✉ Reuben Lembani
reuben.lembani@outlook.com

Extended author information available on the last page of the article

the age of 25 years as well as the expansion of free basic education have led to a fair demand for tertiary education (De Kemp, 2008; Kanwar et al., 2018). Parallel to the rising demand is a shift in the pedagogies used in higher education. Information and Communication Technology (ICT) has become a salient feature in the conventional and Open Distance eLearning (ODEL) education system, thus regulating the quality of teaching and learning (Musingafi et al., 2015; Šorgo et al., 2016; Lembani et al., 2020). As ICT drives the teaching and learning processes of the twenty-first century, both teachers and students need to move with the fast-paced changes associated with the convergence of technology and education (D'Angelo, 2018).

The COVID 19-Pandemic has demanded a need for public health order and small gatherings in well-ventilated academic physical spaces, which has reshaped the teacher-student interactions (Zajda & Rust, 2016; Bai et al., 2020; Viner et al., 2020). The global emphasis on physical distancing is one way of curbing interpersonal transmission risks which has hastened a need to alter the teacher-learner dynamics (Bai et al., 2020; Viner et al., 2020). Many institutions of higher education have adopted blended learning and/or ODeL by using ICT-based learning management systems (LMSs) to deliver educational resources (Edrees, 2013). The restricted face-to-face interactions are supported by virtual classrooms through the use of video communication services such as Zoom, Google Meet, Skype, WhatsApp, and other platforms (Henrie, 2016; Fuady et al., 2021). A recent study (Monk et al., 2020) has reported the importance of blended learning in circumventing the upsets of the global pandemic on the academic calendar and progression. The public health order has rushed the adoption and use of technology which has unequivocally altered the service of quality education. For both the instructors and the learners, one of the greatest challenges is their competence level in the effective use of technology.

Given the increasing adoption of ODeL within the conventional universities, the experience of technology-enhanced learning among the instructors and students' access remains largely unexplored (Bergdahl et al., 2020). In the context of the 2030 agenda for sustainable development goal 4, what is the level of the student's ICT competencies and its effect on the experience of ODeL in an ICT-challenged country? Through the lens of digital competence, what are the factors that influence the student's preparedness? This paper seeks to address these questions through a mixed methods analysis, quantitative and qualitative meta-study, of ODeL students at an inherently conventional university adapting ODeL as an alternative mode of study.

2 Self-directed learning

The approach of self-directed learning has emerged in the thematic area of Open Distance and eLearning (ODEL) and blended learning. The underlining ODeL theory and outcome is that students become more self-directed with some autonomy that is premised to prepare graduates for the demand of the evolving work environment (Din et al., 2016). It entails that the learners ought to take the initiative, with or without the assistance of instructors (Lam et al., 2021). The role of instructors is to provide material resources for learning and formulate the learning outcomes

as well as facilitate continuous assessment and examination of students (Din et al., 2016). Institutions of higher education are investing substantial amounts of money in procuring virtual tools to support self-directed learning. It has been suggested, for example, by Finn and Zimmer (2012) that the benefits of providing students flexible learning opportunities would only be realised if the learning outcomes of the education systems characterise the future of work in a digital economy.

Self-directed learning is a multidimensional construct consisting of three distinct dimensions, (1) behavioural, (2) emotional, and (3) cognitive aspects (De Haan, 2004; Bergdahl et al., 2020). *Behavioural* engagement refers to the student's prior understanding of their role in ODeL and active involvement in learning activities. Unlike the conventional university education where instructors are physically available to guide students through the course material, ODeL is mostly self-directed learning, and this demands the right behavioural attitude which involves a student's understanding and appreciation of the study mode and their role (Lam et al., 2021). The *emotional* dimension deals with the student's attachment to the university and the mode of study, which is reflected by the learner's positive attitude to drive oneself. *Cognitive* engagement refers to the concentration required to acquire the prescribed knowledge through digitised education and involves the required minimum level for effective engagement (Lembani et al., 2020). According to De Haan (2004) and Warf (2019), the ability of learners to handle, read, and interpret information that becomes available through the learning management system is key to ensuring effective student engagement and self-directed learning.

2.1 Increase of ODeL modalities in ICT challenged countries

In the last three decades, African countries have experienced a rapid diffusion of information and communication technologies (ICT), with growth in mobile phone subscribers, personal computer users, and internet users (Andrianaivo & Kpodar, 2011; Monk et al., 2020). The changes in ICT have brought about significant changes in the practice of ODeL. These are encapsulated in the shift by many educational institutions from print-based to online delivery of teaching resources using virtual learning environments and various ICT platforms without any time and place limitations (Arinto, 2016; Moore & Kearsley, 2011, p. 2). A review of developing countries reveals that ODeL is characterised by the convergence of open learning philosophy, pedagogies of distance education, and ICT (Tcheng et al., 2007; Arinto, 2016). Using ICT enables educational institutions to support self-directed learning and collaborative learning conducted through different learning management systems where students submit assessments with a proctored physical examination at the end of the teaching/ learning period.

A mix of factors accounting for poor self-directed study and collaborative learning differs according to context (Kirkwood, 2009; Jović et al., 2017). One factor that might be true in the context of countries challenged by ICT is the student's preparedness or similar level of digital competence to engage in learning through ICT (Parkes et al., 2015; Arinto, 2016; Lembani et al., 2020). Many institutions in developing countries have gone through the stages of establishing technological

infrastructure to support ODeL modalities, but rich pedagogical use of this infrastructure and strategic use of ICT with a view to the different target groups' students are either frail or vague (Aung & Khaing, 2016). Similarly, a study done in Zimbabwe (Musingafi et al., 2015) highlighted the difficulty in the use of ICT as one of the major challenges faced by ODeL students. This is reminiscent of Gaskell's (2009) and Arinto's (2016) observation that the implementation and characterisation of ODeL have in most cases not been considered explicitly.

Studies indicate that internet connectivity in Africa is poor, with only Madagascar (77th), Réunion (82nd), and South Africa (97) in the top 100 countries with the fastest broadband internet speed (Cable, 2014). This translates into a speed of 37 minutes and 55 seconds to download a 5 GB file in Madagascar, while it would take much longer (2 hours, 57 minutes, and 34 seconds) to download the same file in a lower-ranked country like Zambia (178th; Cable, 2014). The effects of slow internet speed on the users are highlighted by Wu (2006), serious psychological, economic consequences, user dissatisfaction, and poor collaborative interactions. This is echoed by the empirical data that show a linear relationship between internet speed, user performance, and the quality of ODeL (Wu & Turner, 2006; Monk et al., 2020).

2.2 Challenges of e-learning

The importance of matching student's expectations of ODeL is important for the growth and acceptance of e-learning. Despite the wide use of ICT, research on e-learning adoption suggests that ODeL is far from reaching full potential due to several challenges that ranges from a lack of ICT infrastructure, lecturers in e-learning pedagogies (Brisson et al., 2015; Trammell & Aldrich, 2016) to difficulties in accessing the study material (Musingafi et al., 2015). Therefore, ODeL does not always translate into the expected experiences. Abdurakhmanova et al. (2020) and Gasnell and Mills (2014) observed that the challenges in developing countries undermines the quality of graduates for the digital economy. Most ODeL instructors in institutions of higher learning are often drawn from the face-to-face as such fail to compensate for the lack of physical presence by creating a supportive environment in a virtual classroom. Brisson et al. (2015) attributed the failure to the fact that most of the teaching professionals are digital immigrants, individuals who grew up before the digital age and have challenges in adapting to digital technologies (Prensky, 2001; Parkes et al., 2015).

Studies by Prensky (2001), Šorgo et al. (2016), and Smith et al. (2020) argue that in many universities there is a disjoint between the lecturers or course instructors and the learners because most students are digital natives who have grown up in the contemporary technological context while lecturers are not. Students are presumed to have grown in ubiquitous environments of interacting with computers, android phones, video games, and other tools of the digital age which is fundamentally different from that of the instructors (Prensky, 2001; Tularam, 2018). However, Jones et al. (2010) and Slechtova (2015) who investigated whether being a digital native is a qualification for successful utilisation of ICT in e-learning at universities

found that the level of ICT literacy skill is not homogenous in England. Jones et al. (2010) identified a number of learners appearing within the digital native generation who included a category of students who make very little use of electronic mails. Another research, conducted by Slechtova (2015), shows that some students are anxious about the use of ICT, which affects the level of attitude and satisfaction in e-learning courses. These findings contradict the conception of digital natives as a group of proficient ICT users.

3 Methodological considerations

The study was conducted at the Copperbelt University, an inherent a traditional face-to-face university which recently adopted ODeL as an alternative mode of providing university education. The formulation and adoption of three policies (1) Institutional ODeL Policy, (2) Quality Assurance, and (3) Quality Guidelines and Standards for ODL has been a major breakthrough aimed at promoting teaching and learning in the ODeL learning environment. This has seen the establishment of staff development and training on programme development and delivery as well as the creation of the department of Learner Support. Furthermore, the university currently has developed a virtual platform, learning management system, to better improve teacher-student interactions and provide real-time correspondences. As one of the institutions through which the government establishes its national educational agenda, the university was an ideal institution of higher education for investigating the practice of ODeL in Zambia. Despite the growth of the ICT sector including coverage, broad-based access, and affordability, the country still has infrastructure challenges for a full transition to a knowledge-based economy.

3.1 Data collection

This research used structured text-based interviews, where an online questionnaire was developed and stored in Google Drive and the link shared through the Learning Management System (LMS). According to Stieger and Goritz (2006) and Shapka et al. (2016) the risk of receiving false information from online interviews is small given that the identity of the person involved in a text-based online interview cannot be confirmed. A total of 366 ODeL registered students were asked to complete the online questionnaire. To investigate the variation of the student's e-learning experience, data was collected from across the learners in different academic levels and programmes. Students were asked to fill out the basic demographic data and provide open-ended information on the experience, for example, reasons for pursuing distance education with CBU and whether they had the prior knowledge about the pedagogies of e-learning. Furthermore, among the many questions on material possession ICT devices and the level of computer literacy, students were asked questions about the device and amount of monthly data bundles used, and the preferred mode of interacting with the course instructors.

Overall, questions were designed to allow for multiple comparisons in responses (Yes or No, and free-response) and the questions were kept simple to increase the likelihood of completing the questionnaire in less than five minutes. Students were provided with space to provide written responses related to the general experience of e-learning and provide recommendations for improving the practice of ODeL. The online questionnaire was administered and responses were received between 11/04/2021 and 14/05/2021 during the month of social-economic lockdown when the university adopted e-learning in response to the COVID-19 outbreak.

3.1.1 Structure and scale of responses

The qualitative responses were categorised into themes based on the broad questions on the students' prior academic qualifications and knowledge of ODeL pedagogy, sponsorship type, ICT competencies and usage, and the experience of ODeL. This structure allowed for statistical analysis and to establish connections between the different sub-themes. Likert scales were used to assign quantitative values to the different sub-themes or responses arising from the 12 questions or themes of the survey:

- i. A 5/ 6-point scale: was used to differentiate the students' variations of agreement. This ranged from "strongly disagree", "disagree", "somewhat disagree", "somewhat agree", "agree" to "strongly disagree" while the responses on prior level of the highest qualification ranged from an equivalency (HAQ) of "school leaver", "certificate", "diploma", "undergraduate degree", "master's degree" to "doctorate". On possession and use of a computer (Device), a scale was assigned based on material possession and use of company computer at "work", "non-personal computer at home" "smart phone", "tablet computer", to "personal computer". Quantitative values were assigned to responses on employment status (Employment), type of sponsorship (Sponsor), the ease of accessing the educational resources (EA.ER), a preferred mode of interaction with the course instructors (P.M.I), as well as the amount of data bundles allocated for studies in gigabyte per month (GB).
- ii. A 4-point scale: was used to measure the students' perceived level of computer literacy or the self-appraisal of their level of computer literacy (ICT competencies) from "illiterate" for students who are not able to perform simple tasks, "basic" for the learners with the ability to perform the fundamental tasks, "advanced" for those with the skill to use a computer and internet to the fullest extent to "proficient" for students who can use computers, internet and the related technology.
- iii. A 3-point scale: measured the students' feelings and experience on the reason for pursuing a university degree through the ODeL mode (RPS), the key challenge encountered (KC), and the convenience of ODeL.

3.1.2 Principal component analysis

Principal component analysis (PCA) in SPSS was applied to reduce the dimensionality of the measured responses and to extract a small number of independent variables that largely explained the student's ICT competencies and experience of ODeL. Instead of predicting from the 10 measured variables of the student's, (i) highest academic qualification, (ii) reason for pursuing studies with CBU, (iii) convenience of the LMS, (iv) allocation of data bundles for studies, (v) the employment status of students, (vi) the ease of accessing educational resources, (vii) type of educational sponsorship, (viii) preferred mode of interactions, (ix) material possession and type of an ICT device (x) prior knowledge of the ODeL pedagogy, and the (xi) key challenge encountered, the first few principal components (PC) were extracted while preserving the variation in the original data (Table 1). The factorability of the measured variables was tested using Kaiser Meyer Olkin (KMO) test of sampling adequacy (0.55) and Bartlett's Test of sphericity (421) which indicated the appropriateness of applying PCA on the dataset ($\rho=0.00$). Based on the decomposition of eigenvalues and varimax rotation, four principal components (PC) were derived to explain student's preparedness and experience of ODeL.

4 Results

4.1 Characterisation of student's experience of ODeL by ICT competencies

The results showed that being in possession of a personal computer influenced the student's frequency use of the ODeL platforms (57% of the 366 students), which aided the development of the basic ICT competencies for e-learning (Table 1). Even though a smart phone is commonly used among the learners, the findings showed that a phone is not ideal for accessing and effectively using the ODeL platforms, with 11% of the total students indicating the challenges of accessing the learning materials and submitting assessments using a smartphone. Among the listed devices, the significance of ICT competencies and convenience of ODeL increased from using a "work computer", "smartphone", "tablet computers" to "personal computer" ($\rho=0.00$). Forty of the total 366 learners showed that having limited ICT competency posed a challenge of having a positive experience of the Open Distance and eLearning mode. The predominant response (57%) on the major challenge is the highest cost of data bundles, with 41% of learners indicating that using more than 5 GB of data bundles per month is what translates into a positive experience (Table 2). Many indicated that being in possession of at least a tablet computer and enough internet data bundles is necessary to improve the ICT competencies:

The university should provide at least tablet computers and attach the cost of the device to school fees for a duration of 4 years so that it can be affordable, this should include providing free data or internet at a subsidised cost.

The results also show a characterisation of the learners' proficiency levels in ICT competencies from "illiteracy", "basic", and "advanced", to "proficiency" literacy

Table 1 Description of variables

No.	Label	Variable	General description
1	Device	Device	Type of a communication product that is used to transmit and receive information electronically
2	KC	Key challenge	A major difficulty that requires effort and determination to effectively learn
3	Preparedness	ICT Competencies	A combination of ICT material possession, skills, and knowledge
4	HAQ	Highest Academic Qualification	The academic qualifications that a student possessed before earning admission at the university
5	PK. ODeL	Prior Knowledge of ODeL	What students knew about the ODeL teaching-learning methods before gaining admission
6	C.ODeL	Convenience of ODeL	The level of satisfaction and enjoyability of studying through the ODeL mode
7	GB	Gigabyte	The amount of data bundles for internet connectivity per month, specifically for e-learning
8	PML	Preferred mode of learning	The mode of study that is mostly enjoyed, e-learning or face-to-face learning during residential school.
9	EA.ER	Ease of Accessing Education Resources	The level of difficulty experienced when accessing the learning material from the online platforms
10	Sponsor	Sponsor	The type of financial support to undertake a university qualification
11	Employment	Employment	The type of the principle profession or means of livelihood
12	RPS	Reason for pursuing studies	The motive or reason for studying with the university through the ODeL mode

Table 2 Percentage of the student's ICT preparedness for the ODeL environment

ICT Competencies (possession and use)	Major Challenge			Experience of ODeL			Very Convenient
	Lack of PC	Limited ICT competency	High Cost of data bundles	Disappointing	Interesting but not user friendly	Convenient	
Possession							
Personal computer, desktop or laptop	–	11	57	6	10	53	
Non Personal computer	1	–	–	–	–	–	
Personal Smart Phone	9	5	10	5	5	13	
Personal Tablet	1	2	0	0	0	2	
Computer at work	2	1	2	0	1	5	
	100			100			
Monthly allocation Data Bundles							
0–0.5 GB	0		0	0	–	0	
0.5–1 GB	1	1	4	1	1	4	
1–2 GB	1	2	6	1	2	6	
2–5 GB	5	5	18	–	5	23	
> 5 GB	5	10	41	7	8	41	
	100						
Levels of computer literacy, personal appraisal							
Illiterate	–	0	–	0	–	–	
Basic literacy skills	4	8	6	2	5	11	
Advanced literacy skills	7	9	45	8	10	42	
Proficient literacy skills	2	1	18	1	2	19	
	100			100			

skills. The convenience of the ODeL environment was higher among the students with advanced ICT competencies (42%) which allowed for effective use of the learning management system and virtual platforms than the students who appraised themselves as being proficient (19%) or having the basic (11%) literacy skills as well as those without the skills (Table 2). The difference in the level of ICT competencies and the need not to leave behind some students with the lower level of literacy is highlighted by a 4th-year student pursuing a Bachelor of Science in Banking and Finance:

Please bring back residential it was helping, the online teaching-learning has network challenges.

4.2 Students' attributes influencing preparedness for ODeL

The majority of the students, 267 out of the 366, indicated that the learning management system and the online platforms are convenient for learning. The few students (7) who did not have the ICT competencies revealed that the university has been exposing their illiteracy instead of imparting ICT literacy and skills. Table 3 shows the correlation coefficients between the student's ICT competencies and the different intrinsic factors that influenced the learner's preparedness for the ODeL environment. The positive correlation between ICT competencies and: the level of prior academic qualifications (HAQ: $r^2=0.35$); key challenge faced (KC: $r^2=0.26$); and the convenience of ODeL (C.ODeL: $r^2=0.18$) are statistically significant ($\rho=0.00$). This indicates the importance of sensitising the prospective students about the modalities and expectations of Open Distance and e-Learning.

The ease of accessing learning resources directly resulted in some positive experience of e-learning ($r^2=0.45$) which in turn was hypothetically influenced by the increasing level of "prior level of academic qualification" (HEA: $r^2=0.22$). Our results show that the ODeL is mainly characterised by students in formal employment with prior education qualification who envision a university degree as a pathway to new career opportunities. This implies that e-learning in higher education has been largely leaving behind students (school leavers) who tend not to have the prior knowledge about the pedagogy used in ODeL:

The university needs to spend more time on orienting us on the use of the LMS platform, how to access tutorials by scheduling more live classes to enable them to provide quicker responses to our questions.

Principal component ordination diagram depicts four principal components (PC's) that explained 50% of the total variance of the students' preparedness and experience of ODeL (Fig. 1 and Table 4). Preparedness, HAQ, P.K.ODeL, GB, and sponsor had proximate ordination and loading in Component 1 which supported the findings that the ODeL learners are mostly the non-traditional university students, and that the higher the "prior academic qualification" the more likely the learners are prepared for the ODeL environment. "Preparedness" also increased with the amount of "data bundles allocation" and having educational sponsorship. In Component 2, the loading of "preparedness" was influenced by the material possession of

Table 3 Pearson correlation matrix

	HAQ	Employment	Sponsor	RPS	PK.ODEL	Preparedness	Device	GB	KC	C_ODEL	EA.ER	P.M.L
HAQ		0.23**	-0.19**	0.10	0.01	0.35**	0.19**	0.03	0.13	.026*	0.22**	-0.08
Employment	0.23**		0.07	0.13	0.02	-0.07	0.02	0.01	-0.00	0.02	0.03	-0.05
Sponsor	-0.19**	0.07		-0.05	-0.01	-0.07	-0.07	-0.07	-0.05	-0.05	0.03	0.09
RPS	0.10	0.13*	-0.05		0.00	0.05	-0.02	-0.08	-0.06	0.02	0.00	-0.15**
PK.ODEL	0.01	0.02	-0.01	0.00		0.04	0.00	-0.06	0.03	0.05	0.05	0.04
Preparedness	0.35**	-0.07	-0.07	0.05	0.04		0.14**	0.01	0.26**	0.18**	0.11	-0.07
Device	0.19**	0.02	-0.07	-0.01	0.00	0.14**		0.04	0.52**	0.14**	-0.02	-0.02
GB	0.03	0.01	-0.07	-0.08	-0.06	0.01	0.04		0.09	0.01	-0.02	0.01
KC	0.13	0.00	-0.05	-0.06	0.03	0.26**	0.52**	0.09		0.14**	0.03	-0.01
C_ODEL	0.26**	0.02	-0.05	0.02	0.05	0.18**	0.14**	0.01	0.14**		0.45**	0.18**
EA.ER	0.22**	0.03	0.03	0.00	0.05	0.11	-0.02	-0.02	0.03	0.45**		0.04
P.M.L	-0.08	-0.05	0.09	-0.15**	0.04	-0.07	-0.02	0.01	-0.01	0.18**	0.04	

Coding of themes or qualitative data and assigning of quantitative values - (1) Highest Academic Qualification (HAQ): school leaver, certificate, diploma, degree, Master degree; (2) Employment: unemployed, informal, formal; (2) Sponsor: self, company, government, other; (3) Reason for Pursuing Studies (RPS): expand knowledge base, competitive in job market, promotion, pursue postgraduate studies; (4) Prior Knowledge of ODeL (PK.ODEL): No, Yes; (5) ICT Competencies: illiterate, basic, advanced, proficient; (6) Device: computer at work, smart phone, tablet, personal computer; (6) Allocation and use of data bundles (GB): 0.5; 1, 2, 5, >5; (7) Key challenge (KC): lack of personal computer, limited ICT literacy, high cost of data bundles; (8) Convenience of ODeL (C.ODEL): disappointing, interesting but not user friendly, very convenient; (9) Ease of Accessing Educational Resources (EA.ER): strongly disagree, disagree, agree, strongly agree; (10) Preferred mode of interactions with teachers/learning (P.M.L): residential school, online, blended learning

**Correlation is significant at the 0.05 level of confidence

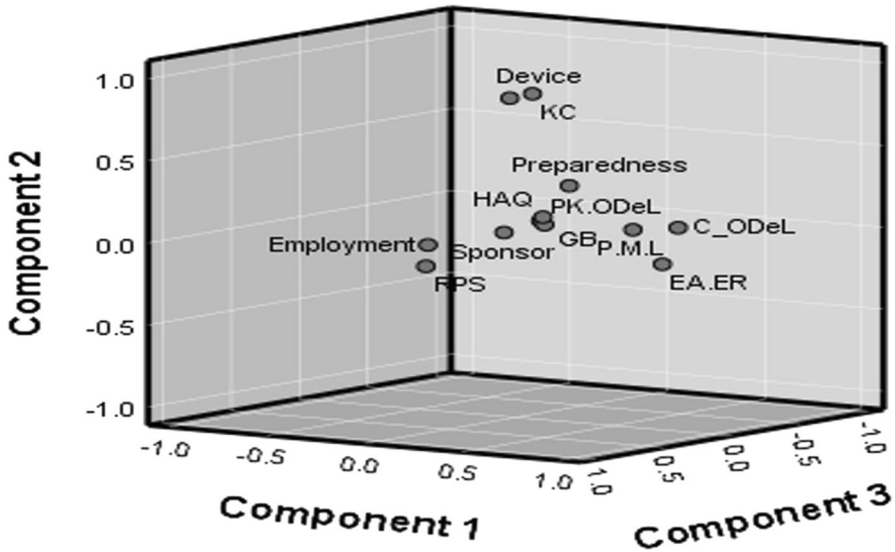


Fig. 1 The PCA ordination diagram of the student attributes in respect to Component 1, 2, and 3 (Component 4 is not depicted, see Table 4). The distances between the variables indicate the strength of the relationship, the closer the data points the stronger the relationship, and vice versa while the ordination indicates either the negative or positive loading to the components

Table 4 Component loading coefficient matrix

	Component			
	1	2	3	4
HAQ	0.23	0.05	0.30	-0.21
Employment		0.06	0.63	0.38
Sponsor		0.10	0.10	0.58
RPS	-0.06	-0.09	0.43	-0.14
PK.ODeL	0.05	0.05	-0.05	
ICT Competencies	0.12	0.14		-0.35
Device	-0.09	0.54		0.08
GB	0.05		-0.07	
KC	-0.06	0.54	-0.06	0.05
C_ODeL	0.48		-0.07	
EA.ER	0.48	-0.14		
P.M.L	0.24		-0.27	0.37

NB: Loadings with an absolute value of less than 0.01 are not shown

a “personal computer”. The negative loading of C_ODeL, EA.ER, and RPS inferred that students who do not easily access the learning resources registered some negative experiences of ODeL and these were the traditional students who responded that the motivation for studying is to expand their knowledge base.

Furthermore, Table 4 shows notable negative loading of Component 3 which included preparedness, C_ODeL, P.K. ODeL, GB, K.C, EA.ER, and P.M.I which indicate that a decrease in “data allocation” (GB), “ease of accessing the learning resources”, and reduced “prior knowledge of ODeL” predicts poor student preparedness which subsequently led to a negative experience of the ODeL. The factors that contributed to the negative loadings in Component 4 (lower preparedness) include the reduced level of academic qualification (HAQ), the amount of data bundle allocation and usage (GB), and the students’ reason for pursuing studies from “post-graduate studies”, “to earn promotion at work”, “to remain competitive in the job market” to “expand the knowledge base”.

5 Discussion

Open Distance and eLearning is gaining acceptance as a parallel or alternative mode of providing higher education. This has been hastened by the cost benefit of ODeL to meet the increasing demand for tertiary education (Zajda & Rust, 2016; D’Angelo, 2018; Kanwar et al., 2018). In our study, the majority of students (72%) with prior knowledge of the basic concepts of ODeL modalities and ICT competencies indicated satisfaction with the e-learning environment. These students were associated with the possession of personal computers (53%), allocated and used 5 GB of monthly data bundles (41%), and appraised themselves as having advanced literacy skills (42%; Table 2). Despite the commitment to promote greater access to university education, the absence of prior understanding of the ODeL pedagogies among some students have continued to produce negative learning experiences. A proportion of 28% of the students with the material possession of ICT devices were sceptical about the e-learning portfolios, describing the experience as “disappointing” (11%) while others recounting the experience as “interesting but not user friendly” (16%). The variance in the students’ expectation and conceptions of the ODeL is not unique to the Copperbelt University or universities in ICT challenged countries. Kirkwood (2009), Jones et al. (2010), and Monk et al. (2020) investigated the variations between the expected experience and the actual experience of e-learning among the digital natives in developed countries such as England with the findings revealing a heterogeneous level of skills and ICT usage. This underlines that the practice of ODeL in ICT challenged countries cannot be seamless, hence the need for continuous construction and improvement of e-learning modalities.

Our study further revealed that ODeL is largely characterised by the non-traditional students with the following characteristics: delayed enrollment into university education, engaged in a formal or informal employment, financially independent, and mostly having at least a higher certificate qualification. The possession of at least one of these attributes is important in equipping students with the capacity to possess a personal computer and enough internet data bundles for studies. The desire to combine employment and studies through self-study entails that the students are prepared for the ODeL environment. Therefore the variance between expectations and experience is marginal for the non-traditional learners because of the cognitive ability to access and process the learning material and assessments that

become available (Din et al., 2016; Bergdahl et al., 2020). Contrary, the traditional students who are mostly school leavers without the prior knowledge about the ODeL modalities often fail to take the initiative of self-directed learning and the negative experience is evident from this study (Kirkwood, 2009; Lam et al., 2021). Unlike the earlier studies that have focused mostly on the challenges of e-learning (Musingafi et al., 2015; Arinto, 2016; Aung & Khaing, 2016; Lembani et al., 2020), our study has shown that the number of positives experiences (73% of the total responses) outweigh the negatives (27%). However, if ODeL is to live-up to the concept of greater access, inclusivity, and flexibility (Gasnell & Mills, 2014; Finn & Zimmer, 2012) there is a need to ensure that no student is left behind. The lack of possession of a personal computer, and affordable internet connectivity as well as the low level of computer literacy skills, entails that the proliferation of ICT in higher education has been leaving some students behind, especially the school leavers who described ODeL as disappointing. The low level of ICT competencies due to little or no exposure to the ODeL pedagogy has also been reported from studies from New South Wales and Australia (Parkes et al., 2015), which provides a consolation to the practice of e-learning in ICT challenged countries. This emphasises a need for continuous construction and evaluation of e-learning orientation programmes designed to eliminate the exclusivism associated with ICT competencies and preparedness for the ODeL environment.

Student preparedness and experience of the e-learning environment is influenced by several factors which could be categorised into ICT competences, students' exposure to ODeL, and the financial resources (Wu, 2006; Parkes et al., 2015; Monk et al., 2020). Firstly, ICT competencies include the type of device used for accessing the learning resources, the amount of internet data bundles used, the ease of accessing the educational resources, and the convenience of ODeL. Secondly, student prior exposure encompassed the level of the highest academic qualification, reasons for pursuing a university, the preferred mode of study, and having knowledge about the ODeL pedagogy. Thirdly, the financial resources that influenced the students' ICT preparedness was inferred from sponsorship, and whether the learner is employed or not (Table 4). The positive correlation between ICT preparedness and: the level of the highest qualification ($r^2=0.35$), convenience of the e-learning environment ($r^2=0.18$), and possession of a personal computer ($r^2=0.14$) over tablet computer, smart phone or work computer highlights the gradation of the information "haves" and their appropriateness for e-learning (De Haan, 2004; Bergdahl et al., 2020; Lembani et al., 2020). Our findings are similar to Šorgo et al. (2016) who observed that smartphones and tablets are for leisure activities that distract learners from educational related applications.

Accordingly, our study emphasises the use of principal component analysis in constructing the learning analytics methods that are suitable for evaluating student data. In the context of greater access and educational inclusivity, this study questions the stereotype of e-learning mode being appropriate for the non-traditional students (Slechtova, 2015; Din et al., 2016; Tularam, 2018), which leaves the traditional students who opt for e-learning with inappropriately aligned ICT competencies for ODeL. In addition to partnering with computer suppliers and internet service providers to give laptops and data bundles at a subsidised cost, this study

further recommends that universities in ICT challenged countries should provide ODeL students with the mandatory pedagogical orientations typical of face-to-face instructions. Principal component analysis supports the clustering of the students attributes into four different categories (Fig. 1 and Table 4). For example, Component 4 clusters EA.ER, C_ODeL, and P.M.L to support the previous study by Neuwirth et al. (2021) that emphasised that the “ease of accessing the educational resources” significantly influences the acceptance and positive experience of ODeL. The effects of the material possession of ICT (Component 2) on computer literacy and the acceptance of e-learning has been widely researched (Andrianaivo & Kpodar, 2011; D’Angelo, 2018; Smith et al., 2020), but studies on the learners prior knowledge of ODeL are not well researched especially from the perspective of ICT challenged countries. Our study shows that having prior knowledge about the ODeL modalities is an important attribute that contributes to students’ preparedness which is important in bridging the variance between the expected expectations and the actual expectations.

6 Conclusion

The study provides evidence that self-directed learning through the ODeL constructivist principles can be challenging in an ICT-challenged country. Two issues from the quantitative and qualitative investigation on the students’ preparedness for ODeL and experience of the e-learning environment emerged. First, the absence of the prior knowledge about ODeL pedagogies among the traditional students have continued to produce some negative learning experiences, with the non-traditional students being more prepared for the e-learning environment. Second, the traditional students who opt for e-learning often have misaligned ICT competencies which give rise to negative experiences. To ensure greater access and inclusivity, orientation on the learning modalities and expectations of ODeL should be mandatory. The study highlights a need for continuous construction of an e-learning environment in higher education to ensure inclusivity in the context of the learners ICT competencies and preparedness for ODeL.

6.1 Limitations of the study

The potential limitation of this study is that the investigation was conducted at a single university (new entrant in open distance education) which restricts the generalisation of the findings. Even so, the digital divide remains a common challenge in the practice of ODeL, this study should be widely applicable in most ICT-challenged countries where the social constructivist paradigm of the university education landscape has enabled the acceptance of ODeL as the alternative mode of acquiring university education.

Acknowledgements This work was supported by the Commonwealth of Learning, British Columbia Canada. Furthermore, we thank the anonymous reviewers for their comments on the earlier version of this paper.

Data availability The datasets generated during and/or analysed during the current study are not publicly available due to the sensitive and identifiable nature of our qualitative data but are available from the corresponding author on reasonable request.

Declarations

Ethics approval The ethical clearance certificate to conduct an online survey on open distance education at CBU was issued by the Copperbelt University' Research Ethics Committee. The certificate dated 8th April 2021 was signed by the Director of Research, Dr. Emmanuel Ogbomida (emmanuel.ogbomida@cbu.ac.zm).

Conflict of interest No potential conflict of interest was reported by the authors.

References

- Abdurakhmanova, G., Shayusupova, N., Irmatova, A., & Rustamov, D. (2020). The role of the digital economy in the development of the human capital market. *International Journal of Psychological Rehabilitation*, 25(7), 1475–7192.
- Andrianaivo, M., & Kpodar, K. R. (2011). ICT, financial inclusion, and growth: Evidence from African countries. *IMF Working Papers*, 2011(073). <https://doi.org/10.5089/9781455227068.001>.
- Arinto, P. B. (2016). Issues and challenges in open and distance e-learning: Perspectives from the Philippines. *The International Review of Research in Open and Distance Learning*, 17(2), 162–180.
- Aung, T.N., & Khaing, S.S. (2016). Challenges of implementing e-learning in developing countries: A review. In *International Conference on Genetic and Evolutionary Computing* (pp. 405–411). Springer.
- Bai, Y., Yao, L., Wei, T., Tian, F., Jin, D. Y., Chen, L., & Wang, M. (2020). Presumed asymptomatic carrier transmission of COVID-19. *Jama*, 323(14), 1406–1407.
- Bergdahl, N., Nouri, J., & Fors, U. (2020). Disengagement, engagement and digital skills in technology-enhanced learning. *Education and Information Technologies*, 25, 957–983.
- Brisson, G. E., Fisher, M. J., LaBelle, M. W., & Kozmic, S. E. (2015). Defining a mismatch: Differences in usage of social networking sites between medical students and the faculty who teach them. *Teaching and Learning in Medicine*, 27(2), 208–214.
- Cable: Internet Speed and Economic Development in Africa (2014). Word Wide Broadband Internet League 2021. <https://www.cable.co.uk/media-centre/release/New-Worldwide-Broadband-Speed-League-Unveiled-UK-Ranks-31>. Accessed 10 Jan 2022.
- D'Angelo, C. (2018). The impact of technology: Student engagement and success. In Power, R. (Ed.) *Technology and the Curriculum: Summer 2018*. EDUC5303G, University of Ontario, Institute of Technology.
- De Haan, J. (2004). A multifaceted dynamic model of the digital divide. *It & Society*, 1(7), 66–88.
- De Kemp, A. (2008). Analysing the effectiveness of sector support: Primary education in Uganda and Zambia. *IDS Bulletin*, 39(1), 36–50.
- Din, N., Haron, S., & Rashid, R. M. (2016). Can self-directed learning environment improve quality of life? *Procedia-Social and Behavioral Sciences*, 222, 219–227.
- Edrees, M.E. (2013). eLearning 2.0: Learning management systems readiness. In 2013 *Fourth International Conference on e-Learning "Best Practices in Management, Design and Development of e-Courses: Standards of Excellence and Creativity"* (pp. 90–96). IEEE.
- Finn, J. D., & Zimmer, K. S. (2012). Student engagement: What is it? Why does it matter? In: Christenson, S., Reschly, A., Wylie, C. (Ed.) *Handbook of research on student engagement*. Springer, Boston, MA. https://doi.org/10.1007/978-1-4614-2018-7_5.
- Fuady, I., Sutarjo, M. A. S., & Ernawati, E. (2021). Analysis of students' perceptions of online learning media during the Covid-19 pandemic (study of E-learning media: Zoom, Google meet, Google classroom, and LMS). *Randwick International of Social Science Journal*, 2(1), 51–56.

- Gaskell, A. (2009). Conceptions of teaching and learning: Revisiting issues in open, distance and e-learning. *Open Learning: The Journal of Open Distance and e-Learning*, 24(2), 109–112.
- Gasnell, A., & Mills, R. (2014). The quality and reputation of open, distance and e-learning: What are the challenges? *Open Learning*, 29(3), 190–205.
- Henrie, C. R. (2016). *Measuring student engagement in technology-mediated learning environments*. Brigham Young University.
- Jones, C., Ramanau, R., Cross, S., & Healing, G. (2010). Net generation or digital natives: Is there a distinct new generation entering university? *Computers & Education*, 54(3), 722–732.
- Jović, M., Stanković, M. K., & Nešković, E. (2017). Factors affecting students' attitudes towards e-learning. *Management: Journal of Sustainable Business and Management Solutions in Emerging Economies*, 22(2), 73–80.
- Kanwar, A. S., Carr, A., Ortlieb, K., & Mohee, R. (2018). Opportunities and challenges for campus-based universities in Africa to translate into dual-mode delivery. *Distance Education*, 39, 140–158.
- Kirkwood, A. (2009). E-learning: You don't always get what you hope for. *Technology, Pedagogy and Education*, 18(2), 107–121.
- Lam, P. L. C., Ng, H. K., Tse, A. H., Lu, M., & Wong, B. Y. (2021). eLearning technology and the advancement of practical constructivist pedagogies: Illustrations from classroom observations. *Education and Information Technologies*, 26, 89–101.
- Lembani, R., Gunter, A., Breines, M., & Dalu, M. T. B. (2020). The same course, different access: The digital divide between urban and rural distance education students in South Africa. *Journal of Geography in Higher Education*, 44(1), 70–84.
- Monk, E. F., Guidry, K. R., Pusecker, K. L., & Ilvento, T. W. (2020). Blended learning in computing education: It's here but does it work? *Education and Information Technologies*, 25(1), 83–104.
- Moore, M. G., & Kearsley, G. (2011). *Distance education: A systems view of online learning*. Cengage Learning.
- Musingafi, M. C. C., Mapuranga, B., Chiwanza, K., & Shupikai, Z. (2015). Challenges for open and distance learning (ODL) students: Experiences from students of the Zimbabwe Open University. *Journal of Education and Practice*, 6(18), 59–66.
- Neuwirth, L. S., Jovic, S., & Mukherji, B. R. (2021). Reimagining higher education during and post-COVID 19: Challenges and opportunities. *Journal of Adult and Continuing Education*, 27(2), 141–156.
- Parkes, M., Stein, S., & Reading, C. (2015). Student preparedness for university e-learning environments. *Internet and Higher Education*, 25, 1–10.
- Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the Horizon*, 9(5), 1–6.
- Shapka, J. D., Domene, J. F., Khan, S., & Yang, L. M. (2016). Online versus in-person interviews with adolescents: An exploration of data equivalence. *Computers in Human Behavior*, 58, 361–367.
- Slechtova, P. (2015). Attitudes of undergraduate students to the use of ICT in education. *Procedia-Social and Behavioral Sciences*, 171, 1128–1134.
- Smith, E. E., Kahlke, R., & Judd, T. (2020). Not just digital natives: Integrating technologies in professional education contexts. *Australasian Journal of Educational Technology*, 36(3), 1–14.
- Šorgo, A., Bartol, T., Dolnicar, D., & Podgornik, B. B. (2016). Attributes of digital natives as predictors of information literacy in higher education. *British Journal of Educational Technology*, 48(3), 749–767.
- Stieger, S., & Goritz, A. S. (2006). Using instant messaging for internet-based interviews. *Cyberpsychology & Behavior*, 9(5), 552e559.
- Tcheng, H., Huet, J.M., Viennois, I., & Romdhane, M. (2007). Telecoms and development in Africa: The chicken or the egg? *Convergence Letter*, 8(16).
- Trammell, B. A., & Aldrich, R. S. (2016). Undergraduate students' perspectives of essential instructor qualities. *Journal of the Scholarship of Teaching and Learning*, 16(1), 15–30.
- Tularam, G. A. (2018). Traditional vs non-traditional teaching and learning strategies - the case of E-learning! *International Journal for Mathematics Teaching and Learning*, 19(1), 129–158.
- Viner, R. M., Russell, S. J., Croker, H., Packer, J., Ward, J., Stansfield, C., & Booy, R. (2020). School closure and management practices during coronavirus outbreaks including COVID-19: A rapid systematic review. *The Lancet Child & Adolescent Health*, 4(5), 397–404.
- Warf, B. (2019). Teaching digital divides. *Journal of Geography*, 118(2), 77–87.
- World Bank (2014). The relationship of bandwidth, interaction, and performance in online courses: A Study. *Africa: Youth employment in Sub-Saharan Africa*. <http://documents.worldbank.org>

[bank.org/curated/en/301371468003940792/pdf/ACS81330WP0P12977300Box385165B00PUBLIC0.pdf](https://www.bank.org/curated/en/301371468003940792/pdf/ACS81330WP0P12977300Box385165B00PUBLIC0.pdf). Accessed 10 Jan 2022.

Wu, C. (2006). Blogs in TEFL: A new promising vehicle. *Online Submission*, 3(5), 69–73.

Wu, Y., & Turner, P. (2006). The relationship of bandwidth, interaction, and performance in online courses: A study. *Online Journal of Distance Learning Administration IX (I)*. Retrieved September 12, 2022 from <https://www.learntechlib.org/p/193170/>.

Zajda, J., & Rust, V. (2016). Current research trends in globalisation and neo-liberalism in higher education. *Globalisation and Higher Education Reforms*, 15, 1–19.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

Authors and Affiliations

Reuben Lembani¹ · Kabwe Mulenga¹ · Peter Mwewa¹ · Lydia Mhango¹ · Nchimunya Chaamwe¹

Kabwe Mulenga
kabwemulenga88@gmail.com

Peter Mwewa
mwewapita@yahoo.com

Lydia Mhango
lydia.mhango@gamil.com

Nchimunya Chaamwe
nchimunya2009@gmail.com

¹ The Copperbelt University, Directorate of Distance Education and Open Learning, Post Office Box 21692 Kitwe, Zambia