Virtual campuses in developing countries: an evaluation of the "right connectors" for effective e-learning in higher education institutions in Zimbabwe

Received 25 June 2022
Revised 29 August 2022
Accepted 15 October 2022

Musa Nyathi
University of South Africa, Pretoria, South Africa

Abstract

Purpose – The purpose of this paper is to evaluate the relative effects of three facets or connectors argued to be vital for learners in successful e-learning outcomes in developing economies.

Design/methodology/approach – Data were collected through a survey involving 130 learners. A stratified sampling technique was employed. Regression analyses making use of linear, multiple and PROCESS macro in Statistical Package for the Social Sciences (SPSS) were used to analyze data.

Findings – Technological self-efficacy and social presence are the most important facets needed by participants for effective learning in higher education institutions in developing countries. Learning tools meant to enhance teaching and learning and also contribute to learner satisfaction.

Practical implications – The findings of the study provide insights to academic administrators to pay close attention to the three connectors in order to ensure quality learning. The findings guide higher learning institutions to adequately and selectively pay attention to the three connections. Deliberate efforts focusing on students' situations, opinions and concerns are vital for learner satisfaction in developing economies.

Originality/value – This study represents a first attempt to examine the effect of the "right connections" for effective learning in developing economies, using a quantitative approach. The findings bring into attention the role of assessing learner inputs and virtual environment in boosting the effectiveness of e-learning. The findings also result in a model that should lead to increased learner satisfaction through the implementation of right connections. The study "disputes" the relevance of a universal e-learning system.

Keywords E-learning, Learner satisfaction, Social presence, Learning tools, Technological self-efficacy, Right connectors

Paper type Research paper

1. Introduction

Global education has over many years exploited advances in information and communication technology to plan for a staged transition from traditional models to e-learning platforms. In developed economies, e-learning has become an alternative but key channel of instructional delivery in higher education institutions (Monash, 2020). This trend has been partly driven by a desire to run away from increasing costs of face-to-face learning (Pete and Soko, 2020). The advantages could be looked at from the service provider's (university) perspective as well as the learner's (client) perspective. From the service provider's perspective, e-learning offers timeliness, learner-centricity, currency, cost-effectiveness, ease of tracking, collaboration and

Journal of Research in Innovative Teaching & Learning
Vol. 16 No. 2, 2023
pp. 253-267
Emerald Publishing Limited
2397-7604
DOI 10.1108/JRIT-06-2022-0040

interactivity (Pete and Soko, 2020). From the learners' perspective, the advantages are flexibility, accessibility, convenience and participation (Nasir, 2020).

In developed economies, the suspension of face-to-face learning as a result of the Covid-19 pandemic saw educational institutions seamlessly transition to e-learning and m-learning. This was made possible by the already existing e-learning platforms that were however being sparingly utilized (Monash, 2020). Electronic learning was perceived as inferior to face-to-face learning in terms of academic rigor and hence the reluctance by a number of universities to introduce it. As a result, the Covid-19 protocols had minimal disruptions in the education sector. This planning was lacking in developing economies. The adoption of e-learning was forced on universities by crisis circumstances in most African countries (Queiros and de Villiers, 2016; Monash, 2020). The implementation was done hurriedly without adequate preparations. When fast tracked and unplanned, e-learning is detested by both facilitators and learners (Barteit *et al.*, 2020).

The objective of e-learning is to develop an effective knowledge economy and enhance lifelong education (Pete and Soko, 2020). It is a transformative tool meant to extend the traditional modes of learning and build capacity in education (Barteit *et al.*, 2020). To achieve this objective, institutions have focused on critical success factors for e-learning effectiveness (Dubey and Sahu, 2021) and learner satisfaction (Tawfik *et al.*, 2018). These studies have categorized success factors into internal and social presence factors. The internal or learner factors are internal to learners such as technological self-efficacy (Alhabeeb and Rowley, 2018). The social presence (virtual environment) factors consist of experiences encountered during the creation and transmission of knowledge (Ng, 2017; Alhabeeb and Rowley, 2018; Nasir, 2020).

The effect of internal factors and virtual environment on e-learning has been extensively researched in developed countries. There is however limited research in developing countries. The contextual factors in developing economies are fundamentally different from those prevailing in the developed world. For example, the Internet penetration rate is 21% for Zimbabwe against an average rate of 87% for the developed countries. The Internet users (a proxy of online users) in Zimbabwe were 62% of the urban population in 2018. That figure dropped to 57% in 2019 and is forecasted to be 54% in 2021 partly due to the rising costs of data (Statistica, 2021).These figures are contrasted to 63% in South Africa in 2019 and a forecast of 65% in 2021 (Statistica, 2021).

The new learning platforms such as mobile-learning (m-learning) and blended learning (b-learning) took time to be adopted by higher learning institutions in developing economies. B-learning in particular, despite its huge benefits, could not be adopted due to the low vaccination rates against COVID-19 virus. The education sector in Zimbabwe remained closed for longer periods due to fears of virus infection. At the beginning of 2021, the USA had 41.8% of the population vaccinated, 0.6% (Africa), 17% (Europe), 5.6% (South America) and 2.3% in Asia (Yuan, 2021).

In Africa, learners and facilitators come to universities with technological backgrounds that are inconsistent. They encounter a virtual environment that lacks the features of face-to-face interactions prevalent in b-learning. The things that students start with contribute more to learner satisfaction than what happens in the course of learning (Queiros and de Villiers, 2016). Contextual e-learning systems that are seen as more relevant and effective to students in developing economies need further research. A number of studies in the developed world indicate the opposite: that social presence factors have a greater impact on learner satisfaction than internal factors (Luo *et al.*, 2017; Quadir *et al.*, 2022). The things that happen in the course of learning, not what the student started with, contribute more to learner satisfaction with e-learning.

There is no known study, using a quantitative research design that has looked at the relative contribution of these three contextual facets or connections unique to developing economies. Previous studies have used qualitative designs to explore the relationship

between the three facets. As such, it is impossible to categorical claim that either facet yields a bigger or a smaller effect and by what magnitude. It is the focus of this study to give a comparative evaluation and the quantum thereof.

2. Theoretical framework and hypothesis development

Despite the low uptake of e-learning by both academics and learners, the phenomenon holds a great appeal to a large number of educational administrators, facilitators and learners due to its flexibility, ease of use and convenience (Ng, 2017; Monash, 2020). Some studies however indicate contrary findings, such as low personal interaction, low motivation, high dropouts and feelings of isolation (Nasir, 2020). Motivated by these limitations, a number of higher learning institutions have adopted m-learning and/or b-learning. B-learning in particular brings together the benefits of e-learning and face-to-face learning. These studies have however not incorporated the effects of the contextual factors in explaining learner experiences. A number of studies have acknowledged the effect of facets most needed by participants in developing economies for successful learner outcomes: technological self-efficacy, social presence and learning tools (Queiros and de Villiers, 2016; Ng, 2017).

The value of e-learning systems is as good as the quality of their implementation and the perceived ease of use by users and beneficiaries or e-learning actors (Queiros and de Villiers, 2016). The theory of social cognitive theory is used to better appreciate the role of technological self-efficacy in enhancing e-learning.

2.1 Social cognitive theory

The social cognitive theory emphasizes that all learning is a result of observing other people's behavior and consequence of it (Bandura, 1997). Three concepts are identified as critical for effective learning: human agency, self-regulation and self-efficacy (Bandura, 2001). Human agency is the concept that states that learners make an intentional decision to invest in learning and enact behavior change. Self-regulation refers to self-generated thoughts, feelings and actions that are planned and cyclically adapted to the attainment of personal goals (Bandura, 2001). Self-efficacy concerns an individual's belief in their capabilities to successfully control actions or events in their lives. These beliefs are based on the individual feeling that they possess the requisite cognitive abilities, motivation and resources to complete the task (Bandura, 1997). There are four main sources of information that create students' self-efficacy: enactive mastery experiences, vicarious (observational) experiences, social persuasions and physiological and psychological states (Bandura, 1997).

2.2 Social integration theory

The social integration theory is employed to better appreciate the importance of social presence in fostering learner satisfaction to the deployment of e-learning systems. The theory attaches great importance to students' learning environments. Students' persistence and performance is a result of interactions between individual students and their peers (peer-peer) and facilitators (peer-facilitator). These interactions could be informal or formal. Informal interactions involve peer-peer discussions whilst formal interactions involve formal discussions, feedback to assignments and tests (student-facilitator). According to the "tenets of the social integration theory, involvement in such communities will enhance a student's sense of belonging through communication and interaction with others in the same environment" (Ng, 2017, p. 17).

2.3 Interaction equivalency theorem

The theory suggests that meaningful learning can occur when at least one of these three forms of interaction is present at a high level: student–student, student–instructor and

student–content. This theorem implies that an online course designer can substitute one type of interaction for one of the others with little loss in educational effectiveness (Rhode, 2009). High levels of more than one of these three modes will likely provide a more satisfying educational experience though these experiences may not be as cost or time effective as less interactive learning sequences. The proposition put forward in this theory is that each student is different and requires a specific mix of interactions to fit specific preferences and needs. This assumption has however not been tested in developing countries.

2.4 Technological self-efficacy and learner satisfaction

Self-efficacy refers to "an individual's perception and belief about his/her achievements to hypothesize and apply a plan of action" (Bandura, 1997, p. 3). In the field of e-learning, it consists of two dimensions of computer self-efficacy and e-learning self-efficacy. Computer self-efficacy is the "confidence that one can perform well across a variety of tasks" (Queiros and de Villiers, 2016, p. 173). Electronic learning self-efficacy "relates to the skills required to use online learning tools such as discussion forums, emails and Internet searches" (Queiros and de Villiers, 2016, p. 173). An increase in technological self-efficacy results in learners preferring and coping with e-learning (Wei and Chou, 2020).

Few researchers have started to question the relevance of an implicit universal e-learning system (Queiros and de Villiers, 2016). Contextual e-learning systems are seen as more relevant and effective to students. A number of vital connectors are seen as being effective for students in developing economies. These are technological self-efficacy, social presence and learning tools (Queiros and de Villiers, 2016). The technological self-efficacy variable in this study is looked at from the *social cognitive theory* (Bandura, 1997). The theory emphasizes the importance of an individual employee's beliefs in his/her capacity to execute behaviors necessary to produce specific successful organizational outcomes. Self-efficacy, in terms of this theory, is a form of self-assessment that helps the understanding of human behavior and performance in a certain task. Computer and e-learning self-efficacy are an individual's perception of his/ her ability to use computers and e-learning platforms in the accomplishment of a task. Prior studies have found self-efficacy to be a critical predictor that directly affects the user's behavioral intention (Tarhini *et al.*, 2017) and e-learning acceptance (Queiros and de Villiers, 2016; Schlebusch, 2018; Lin *et al.*, 2018). Despite the inadequate e-learning infrastructure in developing countries, it is nonetheless, expected that e-learning users with higher level of technological self-efficacy are more likely to adopt the e-learning systems than those with lower self-efficacy. Technological self-efficacy is an influencing factor to predict the intention to use an e-learning system. Hence, this study postulates the following hypothesis:

H1. Technological self-efficacy has a positive effect on learner satisfaction.

2.5 Social presence and learner satisfaction

Social presence represents the individual perception that his/her presence with a group of people is recognized, valued and respected, which boost the feeling of connected to other group members (Quadir *et al.*, 2022). It reflects one's ability to interact with others virtually (Quadir *et al.*, 2022). It serves as a predictor and has been linked with course satisfaction. Social presence involves three key interactions, namely, learner–facilitator interaction, learner–content interaction, and learner–learner interaction (Queiros and de Villiers, 2016; Gunesekera *et al.*, 2019; Quadir *et al.*, 2022).

Two theories lend credence to the importance of social presence to learner satisfaction. They focus on the importance of learner–content, learner–learner and learner–facilitator interactions, the constituent elements of social presence. The *social integration theory* and

interaction equivalency theorem both focus on learner–learner and learner–facilitator integrations. The *social integration theory* emphasizes the importance of a sense of belonging in students to their learning environments through active participation in virtual learning groups (Ng, 2017). The *interaction equivalency theorem* suggests that meaningful learning can occur when at least one of the forms of interaction is present at a high level: learner–learner and learner–facilitator. Course designers can even substitute one type of interaction for another with little loss in educational effectiveness (Rhode, 2009).

Learning satisfaction is not only a function of learner characteristics but the outcome of a process of interactions between individuals and their peers, content and facilitators (Gunesekera *et al.*, 2019). Empirical findings show these interactions enhance learners' sense of belonging through communication and interaction with others in the same environment (Ng, 2017; Gunesekera *et al.*, 2019). When learners feel a sense of integration with other learners, the likelihood of satisfaction increases (Tawfik *et al.*, 2018; Hewet *et al.*, 2019). Learner–facilitator interactions are vital for e-learning learner satisfaction. Facilitators are the drivers of the learning experience (Luo *et al.*, 2017), acquisition of technical skills and motivation. The quality of e-learning is also influenced by learner–learner interactions (Quadir *et al.*, 2022).

The *social constructivist theory* looks at deeper learning as taking place when learners' perspectives and experiences are brought into collaborative work to actively construct knowledge (Luo *et al.*, 2017). It exclusively examines the learner–learner interactions' effect on learner satisfaction. Learning is not simply the assimilation and accommodation of new knowledge by learners, but is the process by which learners are integrated into a knowledge community. According to Hewet *et al.* (2019), for knowledge to be constructed, individuals need to converse and interact with one another. The student-to-student interactions increase the sense of community and encourage learners to work in teams (Luo *et al.*, 2017). The interactions encourage positive attitudes towards e-learning (Tawfik *et al.*, 2018) and enhance learner satisfaction (Hewet *et al.*, 2019). Highly interactive settings are required to facilitate supportive and corrective feedback.

Learner–facilitator interactions enrich the virtual learning environment too in several ways. There is a feeling of better assessment and increased participation in e-learning discussion forums when learner–facilitator interactions are high (Dubey and Sahu, 2021). These findings support the social integration theory's argument on the importance of having a sense of community in virtual learning groups. This category of interactions is said to be the most important of the three interactions (Queiros and de Villiers, 2016). The findings however do not specify the depth and frequencies of these interactions. Notwithstanding this limitation, learner–facilitator interactions enhance learning (Ng, 2017). The second hypothesis is therefore

H2. The social presence connector has a positive effect on learner satisfaction.

2.6 Learning tools and learner satisfaction

Learning tools are "pre-packaged materials" that facilitators use to enhance teaching and learning. With advances in information technology, these tools now embrace computer applications that mediate the learner's interaction with educational content through an electronic interface to facilitate knowledge construction. They include web sites, video clips, chat rooms, blogs, instant messaging, power point presentations and live lectures (Queiros and de Villiers, 2016).

The *interaction equivalency theorem* is used to understand the effect of learning tools on learner satisfaction in a virtual environment. The tools create a learning situation or virtual classroom. Facilitators place educational material, visuals, exercises, assignments and other materials in learning tools for access to a group of learners (Dubey and Sahu, 2021). The

learner–content interaction relates to the time spent interrogating the course material provided (Queiros and de Villiers, 2016). Task and technological characteristics contribute to students' perceived usefulness of learning tools and satisfaction with them. This leads to continued intention to use them (Dubey and Sahu, 2021). The right mix of e-learning tools is required to mediate the learner's interaction with educational content to facilitate knowledge construction. The tools should be developed to fit with students' work goals and needs to enhance continued use and satisfaction. The third hypothesis for this study is as follows:

H3. The learning tools have a positive effect on learner satisfaction.

The technological self-efficacy, social presence and learning tools should jointly enhance knowledge construction. Attempts have been made to rank these connections in order of importance to knowledge construction. No known quantitative study has looked at the comparative effect of these connectors to learner requirements and/or needs in developing countries. The fourth hypothesis is as follows:

H4. The three connections, jointly contribute to enhanced influence on learner satisfaction.

2.7 Operational definitions

(1) Learner satisfaction

It is defined as the pleasure and success, which learners receive from the learning environment (Assodar *et al.*, 2016; Tawfik *et al.*, 2018). Learner satisfaction is thus a result of learner outcome of the learning process and a requirement for successful learning (Mtebe and Raphael, 2018). It covers the entire learner experience cycle from information retrieval through assignment submission, assignment feedback, getting notices, reminders and service.

(2) e-learning

Electronic learning (also known as online learning, virtual learning and web-based learning) is defined as the use of "digitally permitted and technology-facilitated learning devices that use a digital camera, personal computers, digital videos, tablets, projector; OHP, software, operating systems which aid in the interaction of students and teachers" (Eze *et al.*, 2018, p. 34). It is a system that permits the distribution of information through videos and other techniques. It is a modern educational approach where students and teachers follow a structured curriculum programme using advanced information technology that is mediated via the Internet (Mtebe and Raphael, 2018). The phenomenon is about virtual classrooms/lecture rooms enabled by information technology via Internet.

(3) Right connectors

These are critical facets most needed by learners that "link students to their learning and to the institution" (Queiros and de Villiers, 2016, p. 1). They are technological self-efficacy, social presence and learning tools (Queiros and de Villiers, 2016). The connections support learners in their learning. Their effect is significant when deployed to complement each other.

3. Methodology

3.1 Conceptual framework of the study

This study makes use of Queiros and de Villiers' Model (2016) of vital connections for the online learner as its conceptual framework. The framework allows for the assessment of learning to include learner input, learning environment and output (Ng, 2017; Tarhini *et al.*,

2017; Dubey and Sahu, 2021). The framework allows for a quantitative study on the relative importance of e-learning facets (connectors) of technological self-efficacy, social presence and learning tools on e-learning satisfaction (see Figure 1).

3.2 Sampling and data collection

The study focused on two public universities in Zimbabwe with a population of 350 commerce students ($N = 350$). All students on e-learning systems at these two universities made up the population of interest. A cross-sectional quantitative survey research was used to collect data. For sampling purposes, an inclusion criterion was that the persons of interest should have been subject to e-learning experiences for at least two semesters. Two hundred (200) students, from the Faculties of Commerce, made up the sample of interest. Stratified sampling was used to select these respondents. For the sample to be representative, the population was separated into three groups (Part IIs, IIIs and IVs). From each group (stratum), a random sample was made. Data were collected through a structured questionnaire between October 1, 2021 and 31 March, 2022. The instrument was piloted on ten respondents. The instrument was administered online due to the Covid-19 protocols in place. In total, 130 responses were recorded, representing a 65% return rate.

3.3 Research instrument

Measures of e-learning, "technological self-efficacy", social presence, learning tools and learner satisfaction were developed to evaluate the relative importance of three connections required for learner satisfaction.

3.3.1 e-learning. The four-item "e-learning" instrument makes use of the five-point Likert scales anchored with strongly agree and strongly disagree (see Table 1). It was developed from a validated research instrument used by Queiros and de Villiers (2016). The e-learning variable is treated as an independent variable in this study (Queiros and de Villiers, 2016; Tarhini *et al.*, 2017; Dubey and Sahu, 2021), implemented to bring forth conducive learner experiences for effective learning.

3.3.2 Learning tool scale. The three-item "learning tools" instrument makes use of the five-point Likert scales anchored with strongly agree and strongly disagree (see Table 1). It was developed from validated research instruments (Queiros and de Villiers, 2016; Tarhini *et al.*, 2017). The variable is treated as an intervening variable in this study's framework (Dubey and Sahu, 2021), implemented to enrich the learning environment.

3.3.3 Social presence scale. The six-item "social presence" instrument makes use of the five-point Likert scales anchored with strongly agree and strongly disagree (see Table 1). It was developed from validated research instruments (Queiros and de Villiers, 2016). The variable is

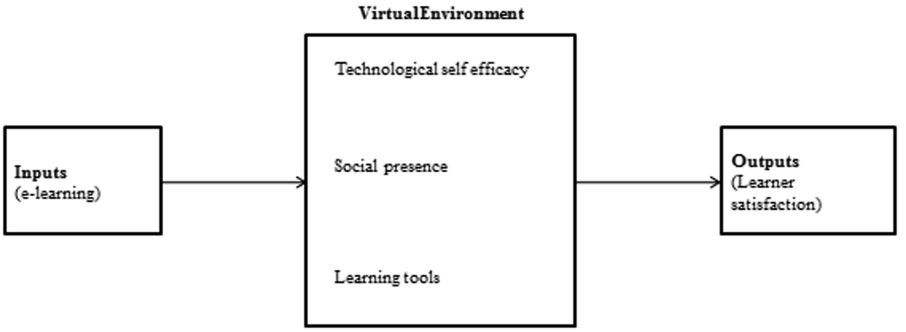

Figure 1.
Input-environment-output framework

treated as an intervening variable in this study (Queiros and de Villiers, 2016; Dubey and Sahu, 2021), implemented to bring forth intended learning experiences.

3.3.4 Technological self-efficacy scale. The four-item instrument was developed from validated research instruments (Queiros and de Villiers, 2016; Tarhini *et al.*, 2017; Lin *et al.*, 2018). The instrument also makes use of a five-point Likert scales with strongly agree and strongly disagree anchors (see Table 1).

Construct	Items	Item loading	$\alpha \geq 0.70$	CR ≥ 0.70	AVE ≥ 0.50	DV
E-learning	The e-learning system is reliability	0.85	0.83	0.81	0.56	0.75
	The e-platform is suited to e-learning	0.74				
	I am satisfied with the flexibility of e-learning system	0.71				
	I am satisfied with the speed of e-learning system	0.69				
Digital self-efficacy	I am able to use a computer and the Internet with ease	0.85	0.91	0.81	0.56	0.75
	What do you consider to be your level of computer skills?	0.81				
	What is your experience with e-learning?	0.71				
	The e-platform I am using is suited to e-learning	0.69				
Social presence	I benefit from peer-peer interaction	0.79	0.77	0.81	0.56	0.75
	E-learning gives me autonomy	0.73				
	There is little disturbance in e-learning	0.72				
	I benefit from interacting with lecturers	0.92				
	I value prompt feedback from lecturers	0.87				
	E-learning allows lecturers to give different types of assessments	0.65				
Learning tools	The video clips helped me understand the application of the information better	0.86	0.82	0.85	0.70	0.84
	The references to web sites enhanced my learning	0.68				
	Video clips helped me remember information better	0.82				
Learner satisfaction	I am satisfied with the online learning environment	0.80	0.81	0.87	0.58	0.76
	The e-learning system improves my ability to integrate information	0.79				
	I value the flexibility that comes with e-learning systems	0.76				
	E-learning systems allow me to accomplish learning tasks	0.75				
	Using e-learning system increases my performance	0.69				

Note(s): DV: Discriminant value

Table 1.
Questionnaire items and measurements

3.3.5 Learner satisfaction scale. A five-item "learner satisfaction" instrument was developed from validated research instruments (Tarhini *et al.*, 2017; Lin *et al.*, 2018). It makes use of the five-point Likert scales with strongly agree and strongly disagree anchors. The "learner satisfaction" variable is treated as a dependent variable in this study (Queiros and de Villiers, 2016; Tarhini *et al.*, 2017; Dubey and Sahu, 2021), an outcome of implementing e-learning (see Table 1).

3.4 Scale validation

Although the scales have been reported in literature, a scale validation process, nonetheless, was carried out. The purpose was to identify and eliminate poorly performing manifest variables for the respective constructs. Once the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed, the measurement models were assessed. To validate the measurement models, reliability and validity tests were carried out.

3.4.1 Reliability measures. Cronbach's alpha statistic is a measure of the internal consistency of a scale. The statistics for the four constructs were e-learning (0.83), technological self-efficacy (0.91), social presence (0.77), learning tools (0.82) and learner satisfaction (0.81) (see Table 1). The values exceed the recommended value of 0.70. The factor loadings of all items exceed the recommended value of 0.50 (Kline, 2016). This means that the scales are reliable and internally consistent. Composite reliability (CR) values, which depict the degree to which the instrument measures the concept that it is intended to measure ranged from 0.81 to 0.87, again exceed the recommended statistic of 0.70. This again confirms the reliability of the measures used in the study (Kline, 2016).

3.4.2 Validity tests. 3.4.2.1 Convergent validity. The convergent validity is the degree to which multiple items to measure the same concept are in agreement. The average variance extracted (AVE) is the determinant of convergent validity of the scale. It signifies the amount of variance captured by a construct from each scale. The value of AVE $\geq$0.5 provides fair evidence for the convergent validity measures for the construct (Kline, 2016). The convergent validity values of the four scales range from 0.56 to 0.70. All the scales are convergent valid.

3.4.2.2 Discriminant validity. This measure establishes the extent to which scores on a construct are not correlated with measures of variables that are conceptually distinct. According to Kline (2016), the square root of AVE values (discriminant values) should be greater than the highest correlations with any other construct for a scale to be discriminant valid. The discriminant validity values range from 0.75 to 0.84, much higher than any correlation among any pair of latent constructs. In total, the measurement model demonstrated adequate reliability and validity.

3.5 Data analysis

Linear, multiple regression and PROCESS macro in Statistical Package for the Social Sciences (SPSS) analyses were performed to test the hypotheses. For the latter analysis, the regression coefficients were calculated based on 10,000 iterations in a bootstrapping model and 95% level of confidence.

4. Findings

The data were checked for its suitability for linear regression analysis. The correlation (R) statistic is 0.588. High correlations ($r > 0.90$) indicate that data could have a multicollinearity problem. The residuals are also independent. The Durbin–Watson statistic is 1.96, close to the recommended value of 2 (Kline, 2016). The scatter plot showed homoscedasticity of residuals. The Cook's distance statistic of 0.048 (with a value greater than 1 being a cause for concern), and the P-P plot of regression standardized residual showed the normal distribution of residuals (Kline, 2016).

Linear regression was performed to find the effect of e-learning (independent variable) on learner satisfaction (dependent variable). The effect of e-learning on learner satisfaction is positive and statistically significant ($\beta = 0.588$; $p < 0.01$). The model explains 0.346 (34.6%) of the variance in the dependent variable (see Table 2). The implementation of e-learning positively predicts learners' satisfaction.

4.1 H1: Technological self-efficacy connector has a positive effect on learner satisfaction

Linear regression was performed to find the effect of technological self-efficacy on learner *satisfaction* (dependent variable). The effect of technological self-efficacy alone on learner satisfaction is positive and statistically significant ($\beta = 0.751$; $p \leq 0.01$). The model explains 0.564 (56.4%) of the variance in the dependent variable. The e-learning environment characterized by learners that are "eloquent" in computer skills and e-learning platforms, positively predict learner satisfaction (Table 3).

4.2 H2: The social presence connector has a positive effect on learner satisfaction

Hierarchal multiple regression was performed to determine the effect of social presence on learner satisfaction. Social presence alone has a positive and statistically significant effect on e-learning satisfaction ($\beta = 0.682$; $p < 0.01$). The model explains 0.465 (46.5%) of the variance in learner satisfaction (see Table 4).

Table 2.
Model summary[b]

					Change statistics					
Model	*R*	*R* square	Adjusted *R* square	Std. error of the estimate	*R* square change	*F* change	df1	df2	Sig. *F* change	Durbin–Watson
1	0.588[a]	0.346	0.341	0.59624	0.346	67.656	1	128	0.000	1.963

Note(s): a. Predictors: (Constant), electronic learning
b. Dependent variable: learner satisfaction

Table 3.
Model summary[b]

					Change statistics					
Model	*R*	*R* square	Adjusted *R* square	Std. error of the estimate	*R* square change	*F* change	df1	df2	Sig. *F* change	Durbin–Watson
1	0.751[a]	0.564	0.561	0.48661	0.564	165.744	1	128	0.000	1.204

Note(s): a. Predictors: (Constant), technological self-efficacy
b. Dependent variable: learner satisfaction

Table 4.
Model summary[b]

					Change statistics					
Model	*R*	*R* square	Adjusted *R* square	Std. error of the estimate	*R* square change	*F* change	df1	df2	Sig. *F* change	Durbin–watson
1	0.682[a]	0.465	0.461	0.53922	0.465	111.223	1	128	0.000	1.736

Note(s): a. Predictors: (Constant), social presence
b. Dependent variable: learner satisfaction

4.3 H3: The learning tools connector has a positive effect on learner satisfaction

The coefficient of learning tools alone, on learner satisfaction is positive, statistically significant and of medium effect ($\beta = 0.284$; $p < 0.01$). The learning tools explain 0.080 (8%) of the variance in learner satisfaction (see Table 5).

4.4 H4: The three connectors, jointly, have a positive effect on learner satisfaction

Multiple regression was run to determine the joint effect of technological self-efficacy, social presence and learning tools connectors on learner satisfaction. The effect of technological self-efficacy on learner satisfaction is positive and statistically significant ($\beta = 0.539$; $p < 0.01$). The social presence effect on learner satisfaction is also positive and significant ($\beta = 0.344$; $p < 0.01$). The effect of learning tools on learner satisfaction is positive and significant ($\beta = 0.063$; $p < 0.01$) see Table 6. The three connectors jointly explain 0.686 (68.6%) of the variance in learner satisfaction.

PROCESS macro in SPSS analysis was also performed to examine if the three variables equally mediate the relationship between e-learning and learner satisfaction. Parallel mediation was performed to determine the indirect effect of technological self-efficacy, social presence and learning tools on learner satisfaction. The indirect effect of technological self-efficacy on learner satisfaction is positive and statistically significant (0.1653). The indirect effect of social presence on learner satisfaction is also positive and significant (0.1260). The indirect effect of learning tools on learner satisfaction is positive and significant (0.0230). The three variables have a combined total indirect effect of 0.3143. The indirect effects of technological self-efficacy, social presence and learning tools are 53, 40 and 7% respectively, of the total indirect effect. The indirect effect of e-learning explains (0.6999) 70%% of the variance in the dependent variable (see Table 7).

5. Discussion

Technological self-efficacy has a positive and significant effect on learner satisfaction. Of the three components under study, technological self-efficacy has the biggest effect on learner

						Change statistics				
Model	*R*	*R* square	Adjusted *R* square	Std. error of the estimate	*R* square change	*F* change	df1	df2	Sig. *F* change	Durbin–Watson
1	0.284[a]	0.080	0.073	0.70691	0.080	11.190	1	128	0.001	1.945

Note(s): a. Predictors: (Constant), learning tools
b. Dependent variable: learner satisfaction

Table 5.
Model summary[b]

	Unstandardized coefficients		Standardized coefficients			95% confidence interval for B	
Model	*B*	Std. error	Beta	*t*	Sig	Lower bound	Upper bound
(Constant)	−0.224	0.159		−1.409	0.161	−0.538	0.091
Technological self-efficacy	0.539	0.063	0.524	8.610	0.000	0.415	0.663
Social presence	0.344	0.058	0.361	5.932	0.000	0.229	0.459
Learning tools	0.063	0.019	0.164	3.253	0.001	0.024	0.101
R-sq = 0.686							

Note(s): a. Dependent variable: learner satisfaction

Table 6.
Coefficients

Path	Coeff	p	LLCI	ULCI	Decision
E-learning → e-learning satisfaction	0.1107	0.01	0.0189	0.2024	Supported
Technological self-efficacy → e-learning satisfaction	0.5167	0.01	0.3937	0.6398	Supported
Social presence → e-learning satisfaction	0.2682	0.01	0.1389	0.3975	Supported
Learning tools → e-learning satisfaction	0.0550	0.01	0.0171	0.0929	Supported
R-sq	0.6999	0.01			

Indirect effect(s) of e-learning on e-learning satisfaction

	Effect	BootSE	BootLLCI	BootULCI
Total	0.3143	0.0436	0.2330	0.4025
Self-efficacy	0.1653	0.0390	0.0979	0.2500
Social presence	0.1260	0.0430	0.0453	0.2130
Learning tools	0.0230	0.0122	0.0034	0.0497

Table 7.
Path coefficients and hypothesis testing

satisfaction. Hypothesis 1 is supported. Technological self-efficacy improves learners' perception of e-learning as well as the adoption rates (Hamdan *et al.*, 2021). This is consistent with findings from previous research (Alqurashi, 2019; Wei and Chou, 2020; Hamdan *et al.*, 2021). It can be concluded that higher technological self-efficacy level results in learners preferring and coping with e-learning, due to reduced anxiety, confusion and loss of control (Alqurashi, 2019). As such, higher self-efficacy results in increased utilization of e-learning systems by learners. When learners are computer proficient, it enables them to enrich interactions between and amongst learners and facilitators as well as improve feedback. Learners should be trained in computer usage prior to adoption of e-learning for effective outcomes.

The result of the study also supported the second hypothesis. The findings indicate that social presence has a positive and significant effect on learner satisfaction. This finding is consistent with findings from previous research (Queiros and de Villiers, 2016; Alsadoon, 2018). It can be concluded that social presence leads to improved learner satisfaction. University administrators need to improve the quality of interactions in the e-learning environment in order to reinforce the effect of e-learning on learner satisfaction. The social presence enriches the quality of learning environments and with that effective learning (Alsadoon, 2018). Social presence is the second most influential facet on learner satisfaction and learning effectiveness.

The third hypothesis is also supported. The findings indicate that learning tools influence learner satisfaction. The effect is positive and significant. Learning tools such as video clips and web sites enhance the quality of learning. They promote deeper and quality interactions, and subsequently, better learning. They allow flexibility in learning as well as reduce the workload for facilitators associated with traditional teaching methods (Mtebe and Raphael, 2018). The findings are consistent with findings from previous research (Queiros and de Villiers, 2016; Mtebe and Raphael, 2018; Hamdan *et al.*, 2021).

The findings from this study rank technological self-efficacy as the important facet for effective e-learning. Social presence is ranked the second most important connector, with learning tools coming third, with minimal effects on positive learner experiences. Course designers and facilitators need to select those facets or connectors that best serve specific learners. The effect of these connectors on learner effectiveness seems to be the same in developing countries (Queiros and de Villiers, 2016). The importance of technological self-efficacy is largely explained by the low information technology competences among learners and lecturers in developing countries (Pete and Soko, 2020). Overall, the findings vindicate the inapplicability of a purely deterministic view of e-learning systems. The systems differ from

one context to another, taking into account the needs, views and perceptions of varying e-learning actors.

6. Contributions of the study

This study contributes to theory development and practice in a number of ways. First, the study provides support to the hypothesized positive relationship between technological self-efficacy, social presence and learning tools, individually and collectively, on the one hand, and learner satisfaction on the other hand. An increase in the quality of technological self-efficacy, social presence and learning tools increases the level of learner satisfaction. Educational administrators have to invest in improving technological competences of learners and facilitators prior to launching e-learning, the quality of the e-learning environment and the use of quality learning tools, in order to increase the level of learner satisfaction. Authorities are further encouraged to establish fully equipped and manned computer laboratories for secondary and post-secondary learning institutions to enhance computer self-efficacy. The training of learners and facilitators in e-learning systems platforms should be institutionalized for better monitoring, appraisal and evaluation. There is a need for institutions to be grounded in customized learning management systems over a period of time for e-learning actors to develop competences in using them. Currently, most institutions have been observed to move from one platform to another, with the choices being heavily determined by cost considerations instead of effectiveness and learner satisfaction.

Second, the findings help policymakers appreciate the relative importance of vital connectors needed by students for effective learning experiences. There should be effective planning to ensure that the information technology adopted is appropriate, user friendly and ably supported within institutions. Policymakers, in developing countries, should integrate computer skills training into the curricula for enhanced skills proficiency by most learners.

At a practical level, the findings indicate that an improvement in technological self-efficacy has the biggest effect on learner satisfaction. Computer self-efficacy and e-learning self-efficacy are "vital connectors in which learners seek support" (Queiros and de Villiers, 2016, p. 179). An improvement in technological self-efficacy increases learners' motivation to study online and subsequently learner satisfaction. Facilitators and learners should be trained in e-learning technology to reduce anxiety and increase learner motivation to adopt and implement e-learning systems. Second, facilitators should encourage computer usage by learners through promoting submission of assignments and research supervision online. Efforts designed to improve the three vital connectors should start with enhancing technological self-efficacy. Social presence and learning tools connectors are enablers of effective learning. Technological self-efficacy is both a necessary and enhancing connector in promoting e-learning in developing countries.

7. Limitations and future research direction

Notwithstanding the successfully attainment of the study's objectives, the findings should be treated with caution for a number of reasons. First, the data on the independent, intervening and dependent variables come from the respondents who participated in the study. A "single source bias" is likely to result. Second, the study was cross-sectional, and as such, it suffers from the well-documented "Neyman bias". Cross-sectional studies tend to fail to capture processes that take time to materialize. This reduces an in-depth understanding of the relationship between e-learning and learner experiences. Causality cannot be inferred. Future research should address the impact of technological self-efficacy on learner satisfaction in developed countries, where technological self-efficacy is already high. Is technological efficacy equally important in developed economies too? There is also need to research on the

size of the effect of these three variables in contexts where e-learning self-efficacy is relatively well developed and adopted (Pete and Soko, 2020).

8. Conclusion

The adoption of e-learning systems in Zimbabwe was forced on higher learning institutions by COVID-19 crisis circumstances. It is now predicted that the pandemic will be around into the foreseeable future. It is increasingly likely that e-learning will now be formalized into a delivery method of choice. During the hashed adoption of online systems, there was no attempt to identify those facets most needed by learners for effective e-learning in different contextual situations. A universal system was deemed appropriate. Researchers adopting qualitative methodologies have identified three facets most treasured by learners for effective e-learning: technological self-efficacy, social presence and learning tools. This study, adopting a quantitative approach has confirmed the ranking of these facets. University administrators are therefore encouraged to develop computer skills and e-learning proficiency amongst learners prior to adopting e-leaning systems. Course designers are encouraged to then build the level of interactions in face-to-face learning to e-learning environments and subsequently adopt blended-learning. University administrators are further encouraged to adopt e-learning tools that impact positively on learner–learner and learner–facilitator interactions for increased learning experiences and satisfaction. Students are different and require specific mix of interactions to fit specific preferences and needs.

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Corresponding author
Musa Nyathi can be contacted at: mnyathi2000@gmail.com