A Systematic Review of the Challenges of e-Learning Implementation in Sub-Saharan African Countries: 2016-2022

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Abstract: Even a cursory review of the research literature over the past two decades will reveal many e-learning implementation challenges facing sub-Saharan Africa Higher Education Institutions. The last available systematic review of these challenges was conducted in 2017. To address this gap and by following the PRISMA-ScR guidelines, our systematic review aimed to find answers to the following two research questions: (a) What e-learning challenges were identified in research conducted in Higher Education Institutions in sub-Saharan Africa from 2016, and (b) Which e-learning challenges identified before 2016 remain and which are new? Using search terms and synonyms associated with e-learning challenges, three reviewers performed a Boolean search in Google Scholar, Web of Science, and Scopus. After duplicates (113) were removed, a total of 353 potential articles were imported into a collaboration platform and filtered using the following inclusion criteria: (1) Higher Education Institutions in sub-Saharan Africa (2) English articles from 2016 to 2022 (3) user data on real-world e-learning implementations are available (4) use of a computer/mobile device excluding m-learning approaches and (5) blended or fully online courses. After a selection process where article sets were reviewed, rotated, and conflicts resolved, 25 articles that met the inclusion criteria formed the primary evidence base. After a data collection process and using selected Grounded Theory techniques, a total of 48 challenges, synthesised in 25 challenge categories, were identified across six themes: university-related (36 citations), instructor-related (20), access-related (14), LMS-related (10), student-related (9) and computer literacy-related (9). The main challenges categories were ICT infrastructure (14 citations), technical support (10) and student bandwidth (8), while the secondary challenges were mainly related to the instructor: commitment and capacity (7), capacity (6), LMS training (6) and instructional design and support (5). Suggestions are offered to address key challenges related to ICT infrastructure, technical support, and student bandwidth. Secondary challenges, which are mainly related to the instructor, are proposed to be resolved by a skilled and energetic instructional design and support team. Although many challenges identified before 2016 were reinforced in this investigation, no new challenges were identified. Overall, the number of citations for specific challenges shows that most challenges are context-specific, that is, limited to single HEIs. However, when combined in challenge categories and reflected as themes, the review reveals many challenges to remain persistent. To ensure that an institution, its instructors, and its students are geared and supported stepwise, a holistic top-down approach that considers all challenges is required. To achieve this, a recommendation for further research is the development of an updated SSA-specific checklist that can be used to rate e-learning readiness in terms of importance and context. The research aims to provide active researchers in the field with an update on the status of research on e-learning challenges in SSA, as well as to make decision-makers aware of potential challenges when implementing e-learning in the SSA context. This may result in better institutional strategies to support e-learning practitioners, as well as to ensure the effective development and implementation of e-learning management systems.

Keywords: Systematic literature review, e-Learning challenges, Sub-Saharan Africa, 2016 – 2022

1. Introduction

E-learning, long touted as the next educational revolution, has been implemented with great success in some countries, but less so in others. Sub-Saharan (SSA), despite being considered the most dynamic e-learning market in the world (Adkins, 2016), also dominates the least developed countries (LDC) category as defined in 1971 by the United Nations (UN, 2011, 2022) with 33 of the 45 recognised LDCs situated in this region. Despite progress made, some key challenges listed by UNESCO (2021) and UNICEF (2021) that continue to exist and hinder the effective implementation of e-learning are a lack of policies to ensure connectivity, including Internet access and Wi-Fi-capable devices for student and teacher use, training, and retraining of teachers in further professional development, including using modern digital tools, and general nonavailability of distance learning. Even a cursory review of the research literature over the past two decades will reveal a multitude of e-learning implementation challenges facing SSA Higher Education Institutions (HEIs).

In his seminal paper, Selim (2007) specified a list of Critical Success Factors (CSFs) for the acceptance of e-learning in a single HEI. He proposed four main categories: 1) instructor, (2) student, (3) information technology, and (4) university support. Since then, a plethora of individual research studies in single countries or individual HEIs has revisited, added, and expanded on his list, in the process adding many factors outside of e-learning

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acceptance. Reviews of such research have been published at regular intervals (e.g., Cheawjindakarn, Suwannatthachote and Theeraroungchaisri, 2013); Elkaseh, Wong and Fung, 2015; Basak, Wotto and Bélanger, 2016; Al-Fraihat, Joy and Sinclair, 2017; Asalla, Putri and Pradipto, 2017). Whereas Selim employed the term CSF, defined as "those things that must be done if a company is to be successful" (Freund, 1988, p.20), it is often misused by e-learning researchers when they mean "challenges". Challenges are assigned to CSFs and form a basis for taking actions to control and master the various CSFs (Françoise, Bourgault and Pellerin, 2009). Therefore, the term "challenges" is a more appropriate term to describe the issues that impact the implementation of e-learning.

An in-depth search of the literature has revealed that the most recent review (scoping, rapid, narrative, systematic, or meta-analysis) on the implementation of e-learning or the adoption challenges of an e-learning management system (LMS) identified in SSA was conducted by Bervell and Umar (2017), who covered research published in the period 2007 - 2017 and is therefore outdated. This raises the broad question: Given the exponential growth of ICT and the rush by HEIs to gain a competitive advantage afforded by e-learning offerings, are the challenges identified by this review still present, and/or have any new challenges been identified?

By adopting a systematic approach, the purpose of our research is to identify, evaluate, and summarise the findings of all relevant individual studies that reported challenges of e-learning in SSA HEIs in the period 2016-2022. The reason for including the years 2016 and 2017 when Bervell and Umar (2017) also covered these years lies in a specific review exclusion criterion that disqualifies the relevance of their literature from these years.

Our specific research questions are as follows:

RQ1: What e-learning challenges were identified in research conducted in Higher Education Institutions in sub-Saharan Africa from 2016?

RQ2: Which e-learning challenges identified before 2016 remain and which are new?

Our research aims to provide active researchers in the field with an update on the status of research on e-learning challenges in SSA, as well as to make decision-makers aware of potential challenges when implementing e-learning in the SSA context. This may result in better institutional strategies to support e-learning practitioners and to ensure the effective development and implementation of e-learning management systems.

The methodology, results, and conclusions are presented next.

2. Methodology

A systematic review uses explicit and systematic methods to collate and synthesise the findings of studies that address the formulated question/s (Higgins, et al., 2019). Two of the most common methodologies used to ensure accurate, complete and transparent reviews are PICO and PRISMA. Both are typically used in clinical research reporting on health interventions, but many of the checklist items can also be used outside of this field. The reporting of our systematic review was guided by the Preferred Reporting Items for Systematic Reviews (PRISMA-ScR) Statement, exclusive of the Meta-analysis Extension. As dictated by the statement, the relevant preferred reporting items for the methodology to be employed in this review are eligibility criteria, information sources, search strategy, selection process, data collection process, data items, risk of bias assessment, and synthesis methods.

2.1 Eligibility Criteria

Inclusion and exclusion criteria were set based on the scope variables of interest, i.e., peer-reviewed research reports not included in previous systematic literature reviews; e-learning challenges identified in existing e-learning implementations and approaches, and that includes user data (feedback). Although language restrictions can result in a risk of bias and reduce generalisability, questions remain about the accuracy of translation programmes, with the result that limiting reviews to English only is common in systematic literature reviews (Jackson and Kuriyama, 2019).

The specific inclusion criteria were:

- Publications in the period 2016-2022.
- Publications in English.
- Publications on e-learning challenges in a sub-Saharan HEI.

- Publications in which challenges were identified from user data, that is, a qualitative, quantitative, or mixed methodology, and reports on the real-world use of an e-learning system/approach were reported.
- The use of a computer or a mobile device, but excluding a dedicated m-learning approach.
- Any blended or fully online courses.

The exclusion criteria were as follows:

- Publications that focused on beliefs, perceptions, and usage intentions (e.g., UTAUT and TAM).
- Publications that evaluated general perceptions of ICT use.
- Publications not published in peer-reviewed journals or conference proceedings, that is, "grey literature".
- Publications offering an e-learning framework and/or strategies only.
- Publications that focus on the architecture of an LMS.
- COVID-19-forced e-learning interventions. Whereas the pandemic forced a dramatic shift towards e-learning initiatives, that "emergency mode" implementations may result in unintended consequences (Kulikowski, Przytula and Sulkowski, 2021) are excluded.
- Testing a novel/newly designed LMS environment and reporting on its success.
- Where the focus is on a single e-learning tool (e.g., a podcast, a webinar, a discussion forum, WhatsApp, etc.).

2.2 Information Sources

To select articles for review, the three current authors, who acted as reviewers, independently searched three databases, namely Google Scholar, Web of Science, and Scopus, during the period August 2022 - October 2022. The Google Scholar index is the most comprehensive of the academic literature (Gusenbauer, 2019). Although Web of Science and Scopus only cover a small option of Google Scholar and tend to cover relatively more from the Engineering, Computer Science, Energy, Chemical Engineering, Chemistry, Veterinary, and Neuroscience fields (Gusenbauer, 2022), Tibaná-Herrera, Fernández-Bajón and De Moya-Anegón (2018) reported Scopus to index 219 journal and congress articles that included e-learning themes between 2012 and 2014. Similarly, for Web of Science, Fatima and Abu (2019) reported that one-third of the total cited e-learning references between 1989 and 2018 were published in 11 journals, the rest scattered across more than 1600 journals. It should be noted that, although Scopus returned most hits from our searches, very few met our inclusion criteria.

2.3 Search Strategy

In addition to the four primary search terms (e-learning, electronic learning, Africa, and challenges), synonyms such as online learning, distance learning, open distance learning, virtual learning, online education, and web-based learning were combined with terms often associated with challenges (CSFs, adoption, usefulness, barriers, vital, pressing, crucial, key, and lessons learnt) using Boolean operators. These additional challenge terms were identified in titles and abstracts from articles sourced from previous searches and added as additional Boolean operators. As an example, an initial search string such as ("e-learning" OR "electronic learning" OR "online learning" OR "virtual learning") AND ("Africa") AND ("critical success factors") was updated to (… AND ("critical success factors") OR "CSFs" OR "challenges" OR "barriers" OR "crucial"). Harzing's Publish or Perish tool, Version 8 (Harzing, 2007) was used to retrieve raw academic citations from the title, abstract, or body text using the title field or keyword field.

Figure 1 offers a methodology processes flow chart that shows the information sources, selection process, data item collection process, and synthesis methods, to be discussed in the following subsections.

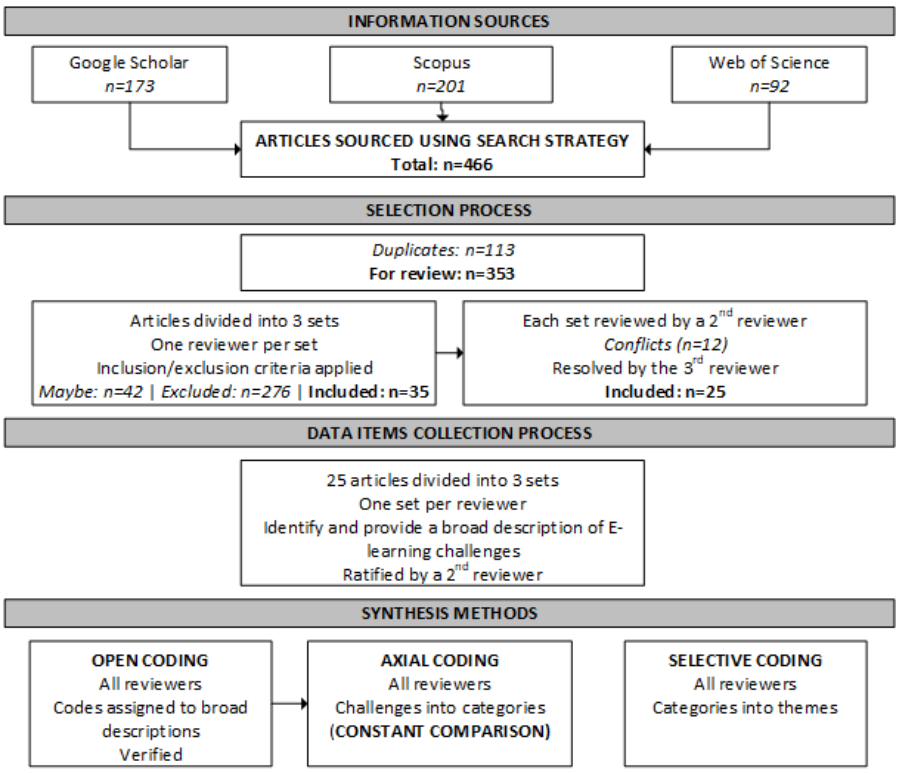

Figure 1: Methodology processes flow chart

2.4 Selection Process

A total of 466 potential citations were sourced from the three databases, exported as a RIS file, and imported into Rayyan (http://rayyan.ai), a web-based system used for collaborative systematic reviews of literature that expedites the initial selection of abstracts and titles.

Once duplicates were removed, a remaining total of 353 abstracts were divided into three sets, each set subjected to the inclusion/exclusion criteria by a single reviewer, who read the abstracts (sometimes scanning the body text if required) and labelled them as 'undecided', 'maybe', 'included' or 'excluded'. The second and third reviewers were trained by the main author, who has extensive experience in qualitative research. At the end of this preliminary process, 42 articles were labelled as 'maybe', 35 as 'included', and 276 as 'excluded'. To reduce the risk of bias and verify the tags, a second reviewer reviewed each set of abstracts and the labels assigned by the first reviewer. If the second reviewer agreed with the original label, the article was included for data collection. If there was disagreement, it was marked as a 'conflict' (12 articles), with the third reviewer required to make a final decision. In all cases, if the abstract was not clear, the full text was consulted. There was no need to contact the authors of any article for more information. After this process, the full text of the 25 articles was downloaded and included in a data collection process.

2.5 Data Item Collection Process

Each reviewer was assigned a set of articles to identify specific e-learning challenges reported in the full article text, which was recorded as a broad description in an MS Word table together with the country where the research was performed, the authors, subjects, and the methodological approach. The latter two elements were included to ensure that the specific inclusion criteria were met. To reduce the risk of bias, the sets were once again rotated with each article and its broad descriptions ratified or, if necessary, revised by a second reviewer.

2.6 Synthesis Methods

In this method, the selected Grounded Theory (GT) techniques of open and axial coding, constant comparison, and selective coding (Strauss and Corbin, 2008) were employed. The document containing the ratified table was imported into Atlas.ti (https://atlasti.com/) as a hermeneutic unit. The three reviewers then met for three sessions in which they employed the open-coding technique to assign concise codes (labels) to the descriptions of the broad challenges. This was followed by a verification session where the codes were reviewed and, if necessary, refined. In the final process, the reviewers used the Network Manager available in Atlas-ti GT and the

technique of constant comparison to sort and organise related codes into categories (axial coding). Lastly, using an adapted GT selective coding approach proposed by Van der Merwe and De Villiers (2011), categories were ordered into classes (themes) according to their attributes.

3. Results

Table 1 lists, in no specific order, the countries where the research took place, the author/s, and a reference number to be used when citing the identified challenge categories (see Table 2).

Table 1: List of studies included in the final review

Country	Authors' references	Reference no.
Tanzania	Mutisya and Makokha (2016)	1
South Africa	Olasina (2019)	2
South Africa	Patel, Kadyamatimba and Madzvamuse (2018)	3
South Africa	Qwabe and Khumalo (2020)	4
Tanzania	Raphael and Mtebe (2016)	5
Nigeria	Yakubu and Dasuki (2018)	6
Malawi	Zozie and Chawinga (2018)	7
Ghana	Ansong, Lovia Boateng and Boateng (2016)	8
Malawi, South Africa, Tanzania, Uganda	Atkins, et al. (2016)	9
South Africa	Azeez and Van Der Vyver (2018)	10
South Africa	Basitere and Ivala (2017)	11
South Africa	Pete, Coopasami and Knight (2017)	12
Sudan	Idris and Osman (2016)	13
Nigeria	Eze, Chinedu-Eze and Bello (2018)	14
South Africa	Faloye and Ajayi (2021)	15
Uganda	Gupta, et al. (2017)	16
Tanzania	Mahenge and Sanga (2016)	17
South Africa	Gani and van den Berg (2019)	18
South Africa	Mafunda and Swart (2020)	19
Namibia	Mässing (2017)	20
South Africa	Msomi and Bansilal (2018)	21
Kenya	Khavugwi (2017)	22
South Africa	Maphalala and Adigun (2021)	23
Tanzania	Mgeni, Ismail, Yunus, and Haji (2019)	24
Tanzania	Mtebe (2020)	25

All 25 included studies were published between 2016 and 2021. Most of the research originated in South Africa (12), followed by Tanzania (6) and Nigeria, Uganda, and Malawi (2 each).

Table 2 lists the themes and *challenge categories* that resulted in the themes, the author reference number/s (from Table 1), the number of citations per challenge, the total citations per category, as well as a total category citation threshold, where challenges with a single citation are considered non-persistent / contextual.

Table 2: Results of the systematic review

Themes	*Challenge categories*	Authors' references	Number of citations per category	Total Category citations	Category citation threshold (3) total
Instructor-related	*I: Instructional design and support*	5, 7, 11, 16, 25	5	20	18
	I: Capacity	1, 5, 7, 18, 20, 22	6		
	I: Commitment	7, 14, 16, 18, 20, 22, 25	7		
	I: Pedagogy	25	1		
	I: Instructor role	2	1		
Student-related	*S: Readiness*	3, 7, 12	3	9	3
	S: Capacity-	1, 2	2		
	S: Experience	2, 21	2		
	S: Finance	10	1		
	S: Familiarity	24	1		
LMS-related	*I: LMS Training*	5, 13, 14, 18, 23, 25	6	10	9
	S: User-friendly LMS	6, 10, 25	3		
	I: User-friendly LMS	6	1		
Access-related	*S: Bandwidth*	1, 4, 7, 16, 17, 18, 21, 24	8	14	14
	S: ICT ownership	11, 12, 16	3		
	I: Bandwidth	1, 5, 11	3		
Computer literacy-related	*I: Computer skills*	1, 7, 14, 18	4	9	9
	S: Computer skills	1, 3, 7, 10, 15	5		
University-related	*U: Policies*	12, 16, 17	3	36	33
	U: Environment	8, 12, 16	3		
	U: Financial constraints	1, 20	2		
	U: ICT infrastructure	1, 3, 5, 8, 10, 13, 14, 16, 17, 19, 20, 22, 23, 24	14		
	C: Copyright	1	1		
	I: Incentives	1, 13, 22	3		
	U: Technical support	3, 5, 6, 9, 12, 13, 15, 16, 22, 24	10		
Totals	25	98	98	98	86

Key: I= Instructor, S = Student, U = University, C = Course

A total of 25 challenge categories, to be deconstructed in the following section, were grouped into six themes: Instructor-related (5 categories), Student-related (5 categories), LMS-related (3 categories), Access-related (3 categories), Computer literacy-related (2 categories) and University-related (7 categories). Note that each challenge category consists of many individual and specific challenges, which will be unpacked in more detail in Section 3.

Although a specific challenge can potentially be placed in multiple challenge categories and/or themes, we followed a best-fit approach. For example, *LMS Training* requirements are arguably more system-related than what it is *Instructor-related,* i.e., when more functionality is added to an LMS, or when tools are complex and/or not user-friendly, or when new tools are added, instructors may require more training. In other words, the need for training does not necessarily originate with the instructor. Similarly, while *Instructional design and support*

can potentially fit in the University-related (support) or the LMS-related theme, the exact online teaching and learning approach is ultimately dictated by the instructor who then requires further support from an instructional design team or through workshops. For this reason, it fits best in the Instructor-related theme. In making these decisions, the authors relied on their experience in an institution that has a long history of online teaching and learning and is considered one of 11 mega-distance teaching universities in the world.

A total of 98 citations were identified. Per category, University-related challenges returned 36 citations, Instructor-related 20, Access-related 14, LMS-related 10, Student-related 9, and Computer literacy-related 9. If a minimum threshold of 3 citations is set, the total number of citations is reduced to 86. However, such a rule will only have one impact on the ranking order, with the Student-related theme moving down to last on the list (University-related 33, Instructor-related 18, Access-related 14, LMS-related 9, Computer literacy-related 9, and Student-related 3). After deliberation, all citations were included to cover potential within-theme and category challenges associations. For example, S*tudent readiness* (3 citations) can also be related to *Student experience* (2 citations). Being immersed in the total data, a best-fit approach was followed.

In ranking the number of citations per category (Figure 2), *ICT infrastructure* (14) and *Technical support* (10) are ranked highest, followed by S*tudent bandwidth* (8), *Instructor commitment* (7), *Instructor capacity* and *LMS training* (6 each). The remainder of the challenges were cited 5 times or less.

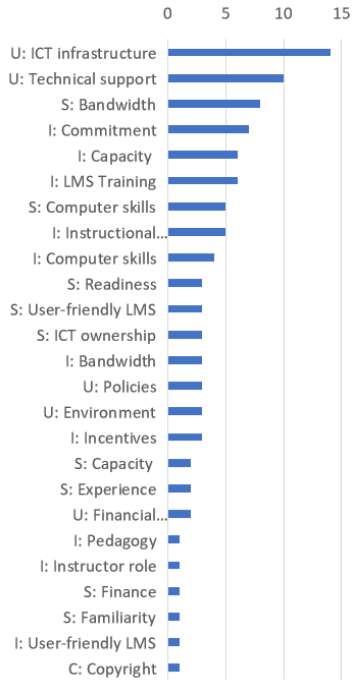

Figure 2: Number of citations per challenge

In the following sections, we unpack the specific challenges per category. Where there are potential within-category challenge associations, they are combined with other challenge categories.

3.1 Instructor-Related

3.1.1 Instructional design and support

Instructional design (Wagner, 2011 p.34) refers to "the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction". This type of design is typically provided by a unit that supports instructors on technical and pedagogical issues, although instructors are sometimes required to design on their own.

Raphael and Mtebe (2016) reported a problem with a shortage of adequately qualified staff to support instructors on technical and pedagogical issues. The quality of instruction is also affected by the online tools used. For example, Zozie and Chawinga (2018) reported that, despite using a variety of media, training is required in other areas, such as video and audio. When using a specific tool such as video streaming, incompatibilities arise when learning hubs bypass guidelines on the hardware and software required (Gupta, et

al., 2017). Using a time-consuming platform offered by an outside company has resulted in student frustration and an unwillingness to use it (Basitere and Ivala, 2017).

Where instructors are required to design on their own, Mtebe (2020) reported that they did not have enough skills and competencies to develop quality instruction, while some instructors also display a tendency to use an LMS as a passive repository (Gupta, et al., 2017).

3.1.2 Capacity

Mutisya and Makokha (2016) found that instructors rank high workloads (the result of many students registering for online courses) as the main reason why they are not embracing e-learning. Raphael and Mtebe (2016) reported the same but added that instructors do not have the skills to manage the increased workload. Gani and van den Berg (2019) also found the workload to be prohibitive, which, although not pertinently stated, is possibly related to another finding that very few students use the LMS. That is, it offers a low return on time investment. An interesting constraint is mentioned by Mässing (2017), who noted that younger managers who govern ICT implementation in learning are overworked because the older generation of instructors does not "take orders" from them. Both Zozie and Chawinga (2018) and Khavugwi (2017) highlighted the increased workload that arises when instructors must redesign/convert the material to electronic format, while the latter noted that the complexity of online teaching can be demanding and time-consuming.

3.1.3 Commitment, pedagogy, and role

A common challenge is the underuse of the features of an LMS. Zozie and Chawinga (2018) reported that despite efforts to communicate its existence, some instructors have a negative attitude toward using technology in teaching. Both Gani and van den Berg (2018) and Eze, Chinedu-Eze and Bello (2018) found experienced instructors to see no reason to change from the analogue to the digital age, the former noting that instructors feel comfortable with the traditional way of teaching. Despite training, Mässing, 2017) found that instructor usage remained near zero, a possible solution is to make it mandatory. Mtebe (2020) found that where instructors use few LMS features, they display little pedagogical skills in using them. As noted by Khavugwi (2017), online teaching requires commitment, while faculty have a direct influence on student attitudes (Olasina, 2019). Gupta, et al. (2017) detailed requirements for suitably qualified and experienced staff but also referred to the need for motivated staff who are naturally interested in e-learning initiatives. Yakubu and Dasuki (2018) reported that information quality (effective teaching by trained instructors that will ensure relevance, comprehensibility, and accuracy) has the strongest influence on student attitudes toward the use of an LMS.

3.2 Student-Related

3.2.1 Readiness, experience, familiarity, capacity, and finance

Both Olasina (2019) and Zozie and Chawinga (2018) identified previous e-learning experience by students as a use factor – the former adding Internet experience and the latter an over-reliance on instructors as the sole provider of teaching and learning resources. Pete, Coopasami and Knight (2017) found that while students were psychologically ready, they lacked technological and equipment readiness, most likely associated with the finding that some students have not had exposure to technology at the school level (Msomi, 2018). To these factors, Mgeni, et al. (2019) added unfamiliarity to the features of an LMS, while Patel, Kadyamatimba and Madzvamuse (2018) found that students lack awareness of e-learning, or are not confident in instructors' support, skills, and usage. Student capacity for e-learning approaches was also identified as a use factor. Although ranked last by students as a problem, Mutisya and Makokha (2016) reported that students, for a variety of reasons, do not have enough time to interact online in a blended learning environment. Olasina (2019) expanded on these factors by identifying stress, workload, satisfaction, fatigue, and time management. Finally, Azeez and Van Der Vyver (2018) stated that e-learning must be affordable for students before they commit.

3.3 LMS

3.3.1 LMS training (instructor)

The need for instructors to be trained on how to use an LMS has been identified in several studies. One of the main findings of Raphael and Mtebe (2016) was the lack of instructors' skills to use the LMS features. Idris and Osman (2016) reported that two-thirds of staff have not received training in e-learning applications, with Eze, Chinedu-Eze and Bello (2018) reporting a 50% figure. Gani and van den Berg (2019) proposed that instructors must undergo training to engage creatively, intentionally, and purposefully with an LMS. Both Mtebe (2020) and

Maphalala and Adigun (2021) stated that skills and confidence in the use of an LMS and its features cannot be achieved with a few days of training, while any LMS update should be followed by further training.

3.3.2 S: User-friendly LMS (instructor and student)

The user-friendliness of an LMS dictates its subsequent use by instructors and students, which in turn is influenced by several factors such as availability, reliability, and design functionalities (Yakubu and Dasuki,2018), simplicity and ease of configuration (Azeez and Van Der Vyver, 2018), and the availability of documentation and help features that impact the user experience and thus student learning (Mtebe, 2020).

3.4 Access

3.4.1 Bandwidth (instructor and student)

Students ranked insufficient Internet connectivity as their key challenge in using an LMS (Mutisya and Makokha, 2016), which affects access time and makes it difficult to complete work (Qwabe and Khumalo, 2020). Interacting with rich media, such as videos, becomes problematic (Zozie and Chawinga, 2018; Gupta, et al., 2017), as do synchronous communications (Gupta et al., 2017). Students who live off-campus are also more affected than residential students, with the former recognised as having limited or no bandwidth (Gupta, et al., 2017; Gani and van den Berg, 2019). Basitere and Ivala (2017) found that poor student performance directly relates to student bandwidth shortages. Expensive bandwidth, of course, affects access to educational opportunities (Mahenge and Sanga, 2016). However, bandwidth limitations on campus also make it difficult for both students (Msomi, 2018; Mgeni et al., 2019) and instructors (Mutisya and Makokha, 2016; Raphael and Mtebe, 2016) to use an LMS effectively.

3.4.2 ICT ownership (student)

Without adequate hardware, e-learning will be impractical. For example, Gupta et al., (2017) and Lucas (2017) reported that most students have trouble accessing the Internet off-campus because they do not have access to computers. Basitere and Ivala (2017) noted that, unlike residential students, off-campus students do not have access to computer resources, resulting in a digital divide that leaves these students frustrated and dependent on the former to complete tests. Not having access to a computer also means that students are not equipped for e-learning (Pete, Coopasami and Knight, 2017).

3.5 Computer Literacy

3.5.1 Computer skills (instructor and students

Computer illiteracy affects both instructors and students. For instructors, Mutisya and Makokha (2016) identified limited ICT skills as the fourth most important factor that prevents them from adopting e-learning. Azeez and Van Der Vyver (2018) and Eze, Chinedu-Eze and Bello (2018) also highlighted basic computer skills as problematic, the latter identifying specific skills such as powering their laptops, composing and sending e-mails, accessing emails, attaching files, and other peripheral issues. Although a lack of computer skills makes it difficult for instructors to use an LMS (Gani and van den Berg, 2019), even those with average skills found the use of more advanced tools such as text-to-speech software, video-editing software, and basic LMS functions, such as uploading material, difficult (Zozie and Chawinga, 2018).

Students ranked computer skills as their second most important challenge (Mutisya and Makokha, 2016), with Patel, Kadyamatimba and Madzvamuse (2018) identifying basic challenges such as an inability to browse the Internet and download useful learning materials, the latter partly due to them not having access to technology. Average computer skills are also problematic when students are required to work with less common operating systems such as Linux or Ubuntu (Zozie and Chawinga, 2018). As Azeez and Van Der Vyver (2018) pointed out, a third of the students highlighted computer illiteracy as a factor that affects their decision to embrace e-learning. However, only 7% and 10% of the students highlighted the lack of basic computer skills or unfamiliarity with technology as a factor, with these students typically coming from disadvantaged schools, which not only reinforces the digital divide but also results in computer anxiety (Faloye and Ajayi, 2021).

3.5.2 University-related

Despite the existence of an e-learning policy, Pete, Coopasami and Knight (2017) concluded that all stakeholders need to analyse how e-learning can benefit a programme and the institution. Gupta, et al. (2017) pointed to policies that support traditional rather than e-learning models. Mahenge and Sanga (2016) attributed the absence of a local policy to the need for a national ICT policy that will guide adoption at the HEI level.

3.5.3 Environment and financial constraints

Ansong, Lovia Boateng and Boateng (2016) concluded that there is an inverse relationship between organisational compatibility and e-learning adoption. Pete, Coopasami and Knight (2017) concluded that various factors, most of which are referenced elsewhere in this paper, combine to create an environment that does not make it easy for students to embrace e-learning. There is also a need for a university to actively move from a non-conventional approach to a virtual approach (Gupta, et al., 2017). However, as stated by Mässing (2017), to receive continuous funding, learning professionals are forced to make ICT solutions available and do so at the expense of training programmes, which is not ideal. Mutisya and Makokha (2016) concluded that the reason for the myriad of challenges is found in the inadequate availability of university financial resources.

3.5.4 ICT Infrastructure

ICT infrastructure, including the lack of hardware (typically in computer laboratories), software, and poor internet and network connections, is highlighted by several authors. Ansong, Lovia Boateng and Boateng (2016) found that the available ICT infrastructure has a significant impact on the adoption rate of e-learning, while an inadequate number of devices leads to challenges using the LMS (Mgeni et al., 2019). The instructors in Mutisya and Makokha's (2016) study ranked the lack of computers on campus as the sixth most important factor that prevents them from adopting e-learning. Other authors who also highlight a shortage of computer hardware are Patel, Kadyamatimba and Madzvamuse (2016), Idris and Osman (2016), Mahenge and Sanga (2016), Mässing (2017), Khavugwi (2017), and Maphalala and Adigun (2021). Mahenge and Sanga (2016), Idris and Osman (2016) and Mässing (2017) identified a shortage of applicable software, while Raphael and Mtebe (2016) and Mafunda and Swart (2020) noted the significant role limited or no ICT facilities at all can play.

Campus network and/or bandwidth-related issues were identified by Azeez and Van Der Vyver (2018), Idris and Osman (2016), Eze, Chinedu-Eze and Bello (2018), Gupta, et al. (2017), Mahenge and Sanga (2016), Mässing (2017), Khavugwi (2017) and Maphalala and Adigun (2021).

3.5.5 Copyright and incentives

Mutisya and Makokha (2016) noted a demand for copyright to be relinquished to instructors for the material they develop. They also highlighted the need for incentives, as instructors felt that they were not rewarded enough (either financially or with promotion) for their increased efforts to go online. Idris and Osman (2016) reported the same, while Khavugwi (2017) added that payment delays are an inhibitory factor.

3.5.6 U: Technical support

Without providing specific details but assumed to be related to both hardware and software, many authors noted an absence of technical support in an e-learning environment (Patel, Kadyamatimba and Madzvamuse, 2018; Raphael and Mtebe, 2016; Atkins, et al., 2016; Idris and Osman, 2016; Faloye and Ajayi, 2021; Khavugwi, 2017 and Mgeni, et al., 2019). Yakubu and Dasuki (2018) are more specific, pointing to a lack of knowledge, empathy, and response of technical staff, while Pete, Coopasami and Knight (2017) mentioned the lack of support staff. Gupta, et al. (2016) identified the need for technical personnel to work together with instructors to develop attractive and easy-to-use systems.

In summary, 48 specific challenges were identified and will form part of our discussion.

4. Discussion

To best answer our research questions, the 48 specific challenges identified in Section 3 were repackaged into Bervell and Umar's (2017) themes (Table 3). Firstly, and somewhat unfortunately, the specific challenges that resulted in the identification of their themes were limited to the number of challenges presented in Column 1 and a few passing references in the body text to 5 critical challenges (i.e., internet connectivity, computers, other hardware facilities, and lack of computer literacy skills and training) and 4 seemingly minor challenges (i.e., software, institutional/managerial) support and policies and system accessibility). The primary author was approached with a request for a complete list of all challenges per theme, but given the time lapse since their review, the raw data are no longer available. Second, this lack of primary data required us to make some assumptions. However, the reader is reminded of the approach followed in constructing our challenge categories and themes: "Whereas a specific challenge can potentially be seated in multiple categories and/or themes, we followed a best-fit approach". As with the current themes, their themes emerged from their data. Since our review has more data items available, it made sense to refit these to their themes rather than the other way around. Also, since some of their themes relate to our current categories, the latter was fitted into

their themes, accompanied by a concise description of the specific challenges as they were unpacked in Section 3.

Table 3: Comparison of the Bervell and Umar review (2017) with the current review

Bervell and Umar (2017) Themes	**Total Challenges**	**Current review** ***Categories (No. of citations) and associated challenges (numbered)***	**Total Challenges**
System-related (quality)	8	*S: User-friendly LMS (3) and I: User-friendly LMS (1)* LMS is not user-friendly LMS is not always available Unreliability of LMS Lack of support documentation Too many LMS features Poor design of LMS	6
ICT infrastructure	13	*U: ICT infrastructure (14)* Lack of hardware Lack of software Poor internet connections Limited facilities *S: Bandwidth (8)* Lack of bandwidth Expensive bandwidth *S: ICT ownership (3)* Ownership	7
Skills/training	13	*I: LMS training (6)* How to use LMS *S: Readiness (3)* Over-reliance on instructors Technology readiness Lack of awareness *S: Experience (2)* Internet experience *I: Computer skills (4) and S: Computer skills (5)* Computer literacy *S: Familiarity (6)* Unfamiliarity with LMS	7
Technical support	4	*U: Technical support (10)* Lack of hardware support Lack of software support Technical staff knowledge Lack of empathy from the support team Lack of response, unavailability The need to work with technical staff	6
Leadership and management support	7	*U: Environment (3) and U: Financial constraints (2)* Lack of organisational compatibility Lack of organisational funding	6

Bervell and Umar (2017) Themes	**Total Challenges**	**Current review** ***Categories (No. of citations) and associated challenges (numbered)***	**Total Challenges**
		New functions implemented without training offered *C: Copyright (1) and I: Incentives (3)* No copyright on the work produced. No incentives for work produced Payment delays for incentives	
Policy issues	7	*U: Policies (3)* Lack of policies	1
Personal issues	3	*S: Finance (1)* Affordability impacts the commitment to e-learning *I: Commitment (7) and I: Instructor role (2)* Negative attitude towards technology use Resistance to change Low use of LMS The commitment and motivation of the instructor impact the use of the LMS by students	5
E-content and e-curriculum	2	*I: Pedagogy (1)* Pedagogical use of LSM tools is lacking *I: Instructional design and support (5)* Shortage of adequately qualified support staff Lack of training in the proper use of e-tools Time-consuming platforms result in limited use Instructors do not have enough skills to create content on their own	5
Time constraints	3	*I: Capacity (6) and S: Capacity (2)* Heavy workload due to large student numbers Lack of skills to manage large student numbers Low return on time investment The complexity of online teaching is time-consuming Demands placed by senior staff on overworked junior ICT staff	6
Totals	60	48	48

4.1 RQ1

RQ1 "What e-learning challenges were identified in research conducted in Higher Education Institutions in sub-Saharan Africa from 2016?" was unpacked in the previous section and is summarised concisely in Column 3. We focus our attention on the number of citations in our review and the challenge totals in both reviews.

Adopting the 3-citation rule and referring to Table 2, the three main and dominant themes were, in order of impact, University-related, Instructor-related, and Access-related. Secondary themes were LMS-, Computer literacy- and Student-related. In general, the challenge categories of *ICT infrastructure* (14), T*echnical support* (10), and *Student bandwidth* (8) attracted the most citations, followed by the secondary challenge categories *Instructor* C*ommitment* (4) and *Instructor Capacity* (6), *LMS training for instructors* (6), *Instructional design and support* and S*tudent computer skills* (5 each). Other than *Student bandwidth* and S*tudent computer skills,* the secondary challenge categories are all related to the instructor.

ICT infrastructure challenges can be solved by sharing limited infrastructure and investment, which will help to lower the cost burden (CRASA & ITU, 2016), as well as using technologies such as cloud computing. The latter option, as an on-demand option, is particularly appealing since it cost-effectively provides services without the

need to install and update software and hardware (Shibi, Kadiri and Aknin, 2013). If the company that provides the service is furthermore appointed to provide *Technical support*, part of the team can be reassigned and offer workshops that focus on *LMS training for instructors* and S*tudent computer skills.*

Once these challenges are resolved, the last mile problem remains - bandwidth, especially for off-campus students. Here it is worth noting that internet access in SSA has nearly doubled from 16% to 30% in the period 2015-2020 (World Bank, 2020). However, such access ranges from 68% in South Africa to 25% in Tanzania (the two countries with the most citations), to the lowest penetration of 7% in the Central African Republic (Kamer, 2022). Innovative and novel solutions such as Facebook and Google's composite terrestrial, high altitude, and satellite systems, and a wide range of advanced photonics technologies and solar power offer promising solutions (Lavery, et al., 2018), but these come at a great cost. Until bandwidth is resolved, e-learning approaches will have to be adapted accordingly, e.g., low bandwidth and asynchronous versions of key content and activities, reducing file sizes by compression and limiting videos, etc.

With reference to the instructor-related categories, employee resistance to technological change has been identified as far back as 38 years by Ewert (1984), who concluded that it is closely related to, amongst other aspects, skill levels required to use new technologies. Miller (2019), in contrast, found that employees are not necessarily resistant, and can become excited (committed) with continued experience, while a well-established LMS reinforces instructor commitment (San-Martín, et al., 2020). It is feasible to suggest that a skilled and energetic *Instructional design and support* team can go a long way in helping to resolve *Instructor Commitment* and *Instructor Capacity*, as well as offer *LMS training for instructors.* However, as noted by Kumar and Ritzhaupt (2017), a better understanding of the exact role of instructional designers is needed, including instructor and student development and support; technical responsibilities such as technical support, web design, and LMS implementation; participation in committees; and summative evaluation of courses and initiatives. The above suggests that they are often not used to their fullest.

4.2 RQ2

To answer RQ2 "Which e-learning challenges identified before 2016 remain and which are new? ", the discussion focuses on Table 3. It is noted that a large part of Bervell and Umar's (2017) review of 31 studies focused on research reporting on intentions and perceptions of LMS use (TAM and UTAUT), as well as the methodological approach used. In addition to their focus on key determinants of acceptance/adoption of LMS acceptance/adoption (Attitude and perceived usefulness, performance expectation, perceived ease of use, and Social Influence), the rest of their inclusion and exclusion criteria mirror ours. Since the current review is interested in the real-world use of an e-learning system/approach, the discussion is limited to implementation challenges identified in 18 of the 31 reviewed studies. Although rudimentary, it nonetheless offers an opportunity to view the current data from a different perspective, thereby contributing to a richer interpretation.

They identified 9 themes and 60 challenges, namely ICT infrastructure and skills/training (13 challenges each), system-related (8), leadership and management support (7), policy issues (7), technical support (4), personal issues (3), e-content/e-curriculum (2) and time constraints (3). In the current review, six themes, 25 challenge categories, and 48 specific challenges were identified. At both the theme and some of the current challenge category levels, it is evident that many challenges remain. However, the challenge totals (60 versus 48), show that fewer challenges were reported in the period 20016-2022. For most themes, the difference in total challenges is negligible. For example, in the System-related (quality) theme, they identified 8 challenges against our 6. For Technical support, it is 4 against 6.

Three observations are made. First, despite the shortcomings in the comparison, no new challenges are evident. Despite the different naming conventions, a reader who has followed research on this topic over the past two decades will immediately recognise many of the themes, challenge categories, and specific challenges. Furthermore, our challenge categories, although emerging, emulate those identified in studies elsewhere in the world. Examples are Instructor and Student Characteristics (Selim, 2007; Alhabeeb and Rowley, 2018) and Technology and/or Support (Selim, 2007; Teoh, 2011; Alhabeeb and Rowley, 2018; Miranda, et al., (2017); McPherson and Nunes, 2006); Management Support, Pedagogy and Learning Approach (Teoh, 2011); E-learning Systems and Online Learning Resources (Alhabeeb and Rowley, 2018); Content and Stakeholders (Miranda, et al., 2017), and Leadership, Structural and Cultural Issues, Design and Delivery Issues (McPherson and Nunes, 2006), and Technological, Infrastructural and Contextual categories (Oyerinde, 2014).

Second, and noteworthy, is the large reduction in skills/training and ICT infrastructure challenges (both from 13 to 7) and policy issues (7 to 1). The totals suggest that with more policies and ICT infrastructure in place, e-learning has become more mainstream, with the result that instructors and students are likely to have more computer skills, are more familiar with e-learning approaches resulting in more experience and less need for training and are therefore more ready to embrace e-learning. However, with e-learning becoming more mainstream, slight increases in challenges related to aspects of technical support, personal issues, e-content, and e-curriculum, as well as time constraints, can be expected. This notion is supported by the challenge of instructor commitment as identified in our review. Its pervasiveness (7 citations) and potential associations across and within other challenge categories, e.g., a lack of incentives and capacity due to heavy workloads, larger student numbers, and the complexity of teaching online, continue to make it difficult for instructors to fully commit to e-learning initiatives and are therefore perhaps worthy of being recognised as an explicit category that deserves specific attention. Once again, the role an active instructional design and support team can play is highlighted.

Finally, in reporting the determinants of LMS acceptance/adoption, they identified several other factors, which appear to be direct challenges, the most relevant to our results being skilled personnel, previous experience, instructor competencies, and course quality. In general, the number of citations for specific challenges reported shows that most challenges are context-specific, that is, limited to a single HEI. However, when combined in challenge categories and reflected as themes, the review reveals many challenges to remain persistent.

5. Conclusions

In concluding the systematic review, research since 2016 has reinforced many challenges identified before 2016. No new challenges were identified. However, if one considers that very few of the listed challenges after 2016 were identified in all HEIs and that all challenges were not present in a single HEI, our review suggests that the challenges identified from 2016 are more context-specific than in previous years, a conclusion that is supported by the low number of citations for many challenges (three and under). At the intersection of the order of challenge categories and the number of citations, it is appropriate to conclude that a top-down yet holistic approach is required to resolve the remaining challenges. There appears to be a move in this direction, with more policies in place to ensure that instructors and students are stepwise geared and supported for specific HEI contexts and circumstances. However, the adage remains that one simply cannot 'throw' more technology at instructors and students and expect it to solve challenges. A range of evaluation checklists, models/frameworks, and strategies for ensuring the successful implementation of e-learning in HEIs (e.g., Atwell, 2006; Fee, 2014; Anstey and Watson; 2018), and specifically for developing countries (Hadullo, Oboko and Omwenga, 2017) have been proposed. A recommendation for further research is the development of an updated SSA-specific checklist that can be used to rate e-learning preparedness in context.

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