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Barriers to digital inclusion in Africa: a systematic review

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Abstract. This study employed a systematic review to determine the barriers to digital inclusion in Africa. A total of 522 documents published between 2012 and 2024 were analysed. The PRISMA flow guidelines explained the inclusion and exclusion criteria for the journal articles. The Mixed Methods Appraisal Tool (MMAT) was used to assess the methodological quality of each selected article. Data were analysed using thematic analysis, which allowed for the systematic identification and interpretation of recurring themes related to digital inclusion in Africa. The analysis revealed eight key barriers to digital inclusion: digital illiteracy, inadequate ICT infrastructure, high costs and limited accessibility, poor Internet connectivity, rural-urban disparities, cybercrime, computer phobia, and language and literacy barriers. The study recommends that policies to tackle digital exclusion in Africa must be holistic. In particular, investment in digital infrastructures and lower ICT service costs may alleviate issues that relate to access and connectivity; improved programmes around the building of digital skills may mitigate the impact of digital illiteracy and computer anxiety; the development of rural areas can reduce geographical inequalities; and cybersecurity policies could generate higher levels of confidence and greater security among users. Additionally, local-language digital content can be supported to circumvent linguistic and literacy barriers.

Keywords: barriers to digital inclusion, digital exclusion, digital inclusion, digital divide, systematic review

1. Introduction

Digitalisation – embedding digital technology into everyday activities, processes and structures across the economy, society and public administration – is transformative at the social, economic and institutional levels [91]. Digitalisation is beyond the adoption of technology; it is a transformative force that changes how society operates. It improves efficiency and allows for innovation to promote inclusiveness and sustain social and economic development. However, several barriers must be overcome to fully unlock the potential of the Internet society – including the digital divide, cybersecurity, and digital literacy [29, 91]. This article reviews digital inclusion in Africa.

Digital inclusion encompasses initiatives, policies, and practices that ensure all individuals and communities, especially the most disadvantaged, have access to and can effectively use digital technologies. Ensuring equitable participation in the digital world requires more than merely providing devices or Internet connections; it necessitates addressing broader factors such as age, income, location, gender, education, and disability [75]. Information and Communication Technologies (ICT) are central to economic development, education and social development in the 21st Century [69]. As ICT increasingly shapes how people learn, work, and connect, digital access is no longer a luxury but a necessity. However, the dream of achieving inclusive digital access and use across Africa remains a challenge due to closely linked factors, as the continent's ability to leverage technology efficiently still lags behind technological advancements.

In the 21st century, apart from enhancing the capacity and functions of computers, technological innovations have also expanded communication through the Internet and the World Wide Web. The introduction of wireless communication devices, blogs, instant messaging, and Voice Over Internet Protocol (VoIP) has dramatically affected how people communicate. With such innovations, people

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can now easily communicate, access, and distribute information. This paved the way for what is now called an information-based society. However, the penetration of ICT, like many other goods and services, has failed to reach the most disadvantaged groups. This gap in digital access has widened the disparities in privileges and opportunities across different societal groups, leading to a division between information-rich and information-poor, often termed information haves and have-nots [73].

Despite global efforts to bridge the so-called "digital divide", Africa continues to experience multi-layered forms of digital divide. Scholars such as Parsons and Hick [72] warn that ICTs are bypassing low-income communities. This concern resonates strongly in African contexts where digital access often mirrors socioeconomic inequalities. While early definitions of the digital divide focused primarily on binary distinctions – those with and without access – this view now appears overly simplistic. Persaud [73] and others argue that today's digital divide encompasses more than just physical connectivity; it also includes disparities in digital literacy, content relevance, confidence in using technology, and sustained access – all of which are deeply influenced by broader structural inequalities. Hawkins and Oblinger [34] highlight a second-order digital divide that encompasses access, usage patterns, skill levels, and digital autonomy. This understanding is particularly significant for Africa, where substantial portions of the population may experience intermittent or passive access to digital tools, lacking the capability or support to utilise them meaningfully. Bradbrook and Fisher's [17] "5 Cs" of digital inclusion – connectivity, capability, content, confidence, and continuity – illustrate the multifaceted nature of the digital divide, particularly in African contexts where several domains are still inadequately developed or investigated.

Research indicates that the digital divide intensifies poverty and further entrenches various forms of marginalisation, including educational inequalities and gender disparities [35, 89, 90]. Developed countries have established effective digital inclusion strategies, evidenced by increasing Internet adoption rates and enhanced digital infrastructure. In developed economies, digital inclusion has been gaining traction through wider Internet penetration and the development of telecom infrastructure. For example, Internet use by Canadians aged 15 years and older increased from 83% in 2012 to 91% in 2018 [81]. Meanwhile, more than 91% and 96% of U.S. and U.K. households, respectively, reported having Internet access by 2023.

Africa, however, is a different story. In 2022, the average Internet penetration on the continent was estimated at 43%, compared to the worldwide average, and broadband access reached only 36% of the population [39, 85]. While mobile connectivity is growing, – 44% of people in Sub-Saharan Africa had mobile subscriptions by the end of 2023, and 27% used mobile Internet, – significant differences persist between countries. Penetration is below 15% in countries such as Chad and Mozambique, compared with more than 50% in South Africa and the Seychelles. The main hurdles are affordability, inadequate infrastructure, and lack of knowledge about digital use [7, 31].

The rapidly evolving digital landscape and Africa's demographic momentum necessitate a systematic, evidence-based understanding of the barriers to digital inclusion across the continent. Through a systematic review, Ogbo-Gebhardt [63] studied the impact of digital inclusion initiatives. He found that digital literacy training was the most common solution in the reviewed literature, followed by broadband subsidies. Aker and Mbiti [7] investigated the relationship between mobile phones and economic development in Africa. They found that in sub-Saharan Africa, mobile phone use has significantly increased over the past decade, now covering 60% of the population. They also found that mobile phones have the potential to benefit both consumers and producers, and to facilitate broader economic development. Nevertheless, Baynit, Mnyanyi and Msoroka [13] characterize research on AI-enabled digital learning in Tanzanian higher education as limited and fragmented, while Ndibalema's [57] systematic review identifies only 14 eligible empirical studies concerning digital literacy in higher education across sub-Saharan Africa. It is argued here that the absence of comprehensive knowledge hinders the formulation of effective, context-specific policies and interventions to address the region's distinct challenges. Okonkwo [67] is one of the few studies that delved into digital inclusion in Africa. However, his focus was on strategies to improve digital inclusion in Africa; the study did not investigate the barriers to it. The lack of systematic evidence on the specific barriers to digital inclusion across diverse African contexts is a key concern addressed

in this study. To bridge this gap, the research conducts a systematic literature review to identify, categorise, and critically analyse the barriers to digital inclusion in Africa. This approach provides a foundational basis for future research, informed policy development, and practical interventions to support inclusive digital transformation across the continent. Guided by this objective, the study seeks to answer the central research question: *What are the barriers to digital inclusion in Africa?*

2. Methods

This study employed a systematic literature review to examine the barriers to digital inclusion in Africa, focusing on research articles published between 2012 and 2024. This time frame was selected based on the observed increase in African scholarly publications addressing digital inclusion during this period, ensuring relevance and contemporary insight into the evolving digital landscape.

2.1. Database search strategy

The articles reviewed for this study were obtained from three databases: Dimensions Scientific, ERIC, and Google Scholar. My first preference was the Dimensions scientific database; thus, I started by analysing articles from it. This digital platform was considered due to its "ability to link and offer rich contextual search and data, visualisation of huge amounts of data, which include the number of citations per publication" [58, p. 4]. However, I could not collect a sufficient number of the most relevant articles for this study, as only seven were retrieved from Dimensions. This could be linked to the argument that little has been documented about digital literacy in Africa. Thus, I had to turn my search to ERIC and Google Scholar. ERIC is among the most frequently used digital platforms by scholars. The ERIC database was selected for its robust analytical tools, including filters for publication date, descriptors, source, author, publication type, and location. Google Scholar is also one of the digital platforms scholars most commonly use. This study selected Google Scholar because it offers analysis tools such as year, date, and publication type. The ERIC and Google Scholar databases are also considered alternatives to other databases, such as Dimensions, Scopus and Web of Science, which offer citation analysis and allow some research evaluation [82].

2.2. Literature search strategy

Usually, the literature search process is essential to ensure that a systematic review includes the most relevant literature [50]. In this study, a keyword search strategy was used to identify articles for inclusion in the analysis. The two Boolean operators 'AND' and 'OR' were used during the search process. Two comprehensive search strings were applied across databases:

i. "Digital inclusion" OR "Digital access" OR "Digital equity" OR "E-inclusion" OR "E-accessibility" OR "Digital exclusion" OR "Digital divide" AND "Africa".

ii. "ICT access" OR "Technology inclusion" OR "Digital participation" AND "Africa".

The database search was conducted on 15 March 2025. The search was limited to publications between January 2012 and December 2024. Only articles published in English were included. The search was limited to open-access journal articles to ensure full-text accessibility, enabling deeper analysis beyond the information in abstracts. The non-access publications were excluded for two main reasons: (i) Cost and access limitations: many closed-access articles require expensive subscription fees or are exclusively accessible through a purchase procedure. Their partial or absent institutional access led to inconsistent, potentially distorted sampling, with a focus on more well-resourced institutes. (ii) Commitment to transparency: limiting the review to free, open-access material allows other African researchers, practitioners and policy makers in a similar position the chance to access the same texts for free and encourages equitable uptake and repeatability.

The study excluded book chapters, conference proceedings, edited volumes, preprints, and monographs, as these sources may lack the empirical rigour required to explain the digital divide in the African context adequately. A total of 522 research articles were retrieved and analysed from the two databases. I used the first 100 results from Google Scholar [33], from which 100 of the 522 retrieved documents were obtained.

2.3. Inclusion and exclusion criteria

Articles were screened using clearly defined inclusion and exclusion criteria to ensure the validity and relevance of the selected studies. These criteria facilitated the identification of articles aligned with the study's topic and objectives. Table 1 below summarises the inclusion and exclusion criteria used.

Table 1
The employed inclusion and exclusion criteria.

Criteria	Inclusion	Exclusion
Publication year	Articles published between January 2012 and December 2024	Articles published before January 2012 and articles published after December 2024
Accessibility	Open-access articles only	Closed-access articles
Nature of articles	Only empirical and peer-reviewed articles	Review and non-peer-reviewed publications
Population	Africa	Any publication outside of Africa

Review and non-peer-reviewed publications (e.g. book chapters, edited volumes, and conference proceedings) were excluded because they often follow less standardised peer-review processes than those of journal articles. I excluded them because I worried that the inconsistency could compromise comparability across sources and reduce the methodological quality required for a rigorous systematic review. Also, many conference papers and book chapters usually present preliminary findings, conceptual discussions, or theoretical overviews. Sometimes they lack empirical evidence. The current study intended to review empirically grounded evidence on the barriers to digital inclusion; thus, including non-empirical studies would risk diminishing analytical reliability.

2.4. Screening procedures

The screening process adhered to the PRISMA structure and was performed in three stages:

1. *Title screening*: The titles of the retrieved articles ($N = 522$) were screened for relevance to digital inclusion and Africa in general.

2. *Abstract screening*: The abstracts of potentially eligible papers were screened for conformity to inclusion criteria, appropriateness and acceptability of methodology, and relevance.

3. *Full-text screening*: Full-text articles were screened to determine whether they satisfied the following: addressed barriers to digital inclusion, were empirical and peer-reviewed, focused on African populations, and were published as open-access.

2.5. Duplicate removal

The retrieved records were exported in RIS format, manually recorded for Google Scholar, compiled into a spreadsheet for organisation, and subsequently imported into MAXQDA for screening and analysis. Duplicates were manually screened and removed during data import into MAXQDA. A total of 27 duplicate articles were identified and removed from the list.

2.6. Process flow of the systematic review

The current study followed the PRISMA flow guidelines to guide article selection for the review. Figure 1 below summarises the selection process.

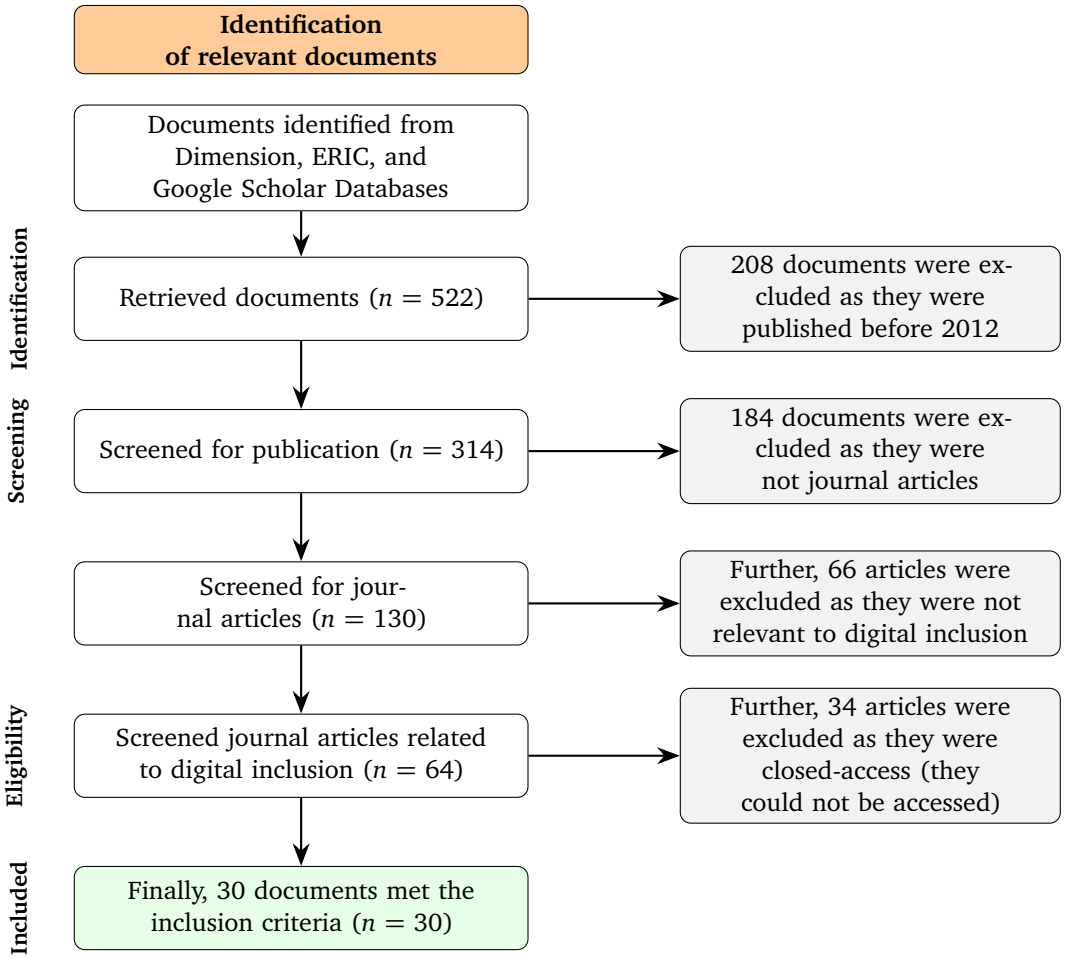

Figure 1: Flow diagram for systematic reviews following the PRISMA [70] model.

Analysis from the PRISMA flow diagram in figure 1 indicates that 522 documents were initially retrieved from the three scientific databases: Dimensions, ERIC, and Google Scholar. The initial screening excluded 208 documents, as they were published before 2012. After the second screening, 184 documents were excluded because they were not journal articles. Further screening excluded 66 documents not directly related to digital inclusion, yielding 64 eligible articles. A subsequent screening phase was conducted to ensure that only the most relevant and accessible articles were retained. During this final stage, 34 closed-access journal articles were excluded due to limited accessibility. Ultimately, 30 open-access journal articles were included in the study for detailed analysis.

2.7. Quality assessment procedures

Two independent senior researchers from one of the Tanzanian universities were requested to review the 30 selected articles to assess their quality. The Mixed Methods Appraisal Tool (MMAT) was used to assess the methodological quality of each article. Each article was evaluated using seven questions for each category of specific method (appendix A). Any inconsistencies that arose among reviewers were resolved through discussion with the researcher. Each article was evaluated and assigned a score out of 7, with each "Yes" response contributing one point. The scores for the assessed articles

ranged from 3 to 7. A consensus was reached among the coders and the researcher to exclude any articles scoring below 3 from further analysis. The additional evaluation relied on the quality of the journals that published the selected articles. Three issues were considered in evaluating the quality of the journals: quartile index, h-index, and journal indexation. The journal was supposed to have at least one of the three criteria to be considered relevant. This view is in connection with Koushik [45, p. 1], who argues that the quality of a journal can be measured by assessing the indexation of that particular journal. A similar perspective was observed by Jolly [42]. To achieve this, Scimago was used to evaluate the quartile and h-index of the retrieved journals.

This study notes that Scimago is used Scopus data to generate quartile rankings and h-index scores; Scopus was not part of the search databases in the current study. The use of Scimago in the current study was not aimed at retrieving articles, but at determining the quality of journals that had already been retrieved from Dimensions, ERIC, and Google Scholar. Scimago is well-known for providing easily accessible, standardised, and comprehensive journal metrics. Thus, I believe it is relevant for post-selection quality assessment, even when Scopus is not used as a search database, as in the current study.

Table 2 summarises the quartile, h-index, and indexation status of the reviewed journals.

2.8. Data analysis procedures

The collected data were analysed using thematic analysis, following an inductive approach that allowed themes to emerge organically from the selected studies [22]. The analysis began with a review of abstracts and keywords, followed by repeated readings of the full texts while reflecting on the research question to develop a comprehensive understanding of the material [83]. Emerging ideas were highlighted and annotated using track changes, then transferred to a separate document to compile an initial list of topics. These ideas formed the foundation of the coding process as explained by Msoroka [55]. Similar topics were subsequently grouped and organised into broader themes, each labelled to represent the underlying categories best [11]. In this study, the intercoder reliability was established by a collaborative coding method (involving coders) to increase the findings' trustworthiness [62]. Having the themes at hand, I invited two senior staff members to code part of the data. These two researchers independently coded a sample of the data, and disagreements were discussed and settled by consensus. This process ensured the consistent application of codes and reduced potential bias.

Using MAXQDA 24, a systematic coding scheme was developed and implemented to ensure a thorough, transparent examination of the qualitative data. Papers were uploaded into the system (software). After importing the 30 eligible articles into the software, an inductive coding approach was used. I started with line-by-line coding of relevant extracts, guided by MAXQDA's coding stripes and highlighting features. These features allowed me to track how ideas emerged across the data. As initial topics appeared in the texts – such as digital illiteracy, insufficient ICT infrastructure, and/or limited Internet connectivity – I created codes in MAXQDA's Code System panel. These codes were refined throughout by constant comparison to capture the meaning of the data. With the assistance of previously coded manuscripts, the sentences, phrases, and words were coded using appropriate codes and sets that reflected the themes in the MAXQDA project. This process simplified the grouping of all related ideas into the appropriate themes.

In this study, the relevance of each barrier was determined qualitatively through a thematic approach. Barriers were considered significant when they showed strong cross-study recurrence (saturation), provided a central explanation within individual papers, and added substantially to understanding why digital exclusion persists. Based on these qualitative criteria, the analysis identified digital illiteracy, insufficient ICT infrastructure, limited Internet connectivity, Internet crime, computer phobia, illiteracy and language barriers, rural-urban disparities, and the cost of ICT services and accessibility as the key barriers to digital inclusion in Africa.

Table 2
Quartile, h-index and indexation.

S/N	Journal	Quartile	h-index	Indexing database
1	African Journalism Studies	2	22	Scopus, Web of Science, EBSCO, Index Islamicus
2	Mediterranean Journal of Social Sciences	3	34	Scopus, Web of Science, Clarivate Analytics
3	Africa Education Review	3	14	Scopus, Web of Science, ERIC, EBSCOhost, ProQuest
4	South African Computer Journal	3	11	Scopus, DOAJ, SciELO SA, Index Copernicus
5	International Journal of Applied Linguistics & English Literature	N/A	16	Index Copernicus, CNKI Scholar, ERA, CiteFactor
6	Information Technologies & International Development	2	5	Scopus, Emerging Sources Citation Index (Web of Science), CiteFactor, DOAJ
7	International Journal of Educational Research Open	1	15	Scopus, DOAJ, OpenALEX, ROAD
8	Information Technology for Development	1	52	Web of Science, Scopus
9	Global Studies of Childhood	2	20	Scopus, Web of Science
10	Information Technology for Development	1	59	Scopus, Web of Science – The Social Sciences Citation Index
11	Open Praxis	2	14	Scopus, Web of Science
12	Journal of Education and Learning	4	6	Scopus, ERIC, Web of Science
13	Global Journal of Computer Science and Technology	N/A	N/A	EBSCOhost, Ulrich's International, Infobase Index
14	International Journal of E-Learning & Distance Education	N/A	N/A	ERIC, DOAJ, Ulrich's International, Periodicals Directory
15	Research in Social Sciences and Technology	N/A	N/A	ERIC, EBSCOhost, Norwegian Register, Index Copernicus
16	Journal of Comparative & International Higher Education	N/A	N/A	ERIC, CiteFactor
17	International Journal of E-Learning & Distance Education	N/A	N/A	ERIC, Education Source
18	Research in Social Sciences and Technology	N/A	N/A	ERIC, EBSCOhost, Index Copernicus
19	TIJER – International Research Journal	N/A	N/A	Thomson Reuters Indexing, DOAJ, CiteSeerX
20	Indonesian Journal of Multidisciplinary Research	N/A	N/A	Science and Technology Index (SINTA)
21	International Journal of Educational Technology and Learning	N/A	N/A	Academic Resource Index, EconPapers, IDEAS, RePEc
22	Journal of Research Innovation and Implications in Education	N/A	N/A	Norwegian Scientific Index
23	Journal of Issues and Practices in Education	N/A	N/A	AJOL
24	South African Journal of Information Management	N/A	N/A	Web of Science, DOAJ, EBSCOhost, Pro-Quest
25	Interdisciplinary Journal of Economics and Business Law	N/A	N/A	American Econ. Lit., ProQuest

3. Results and discussion

This section presents and discusses the key findings generated from the systematic review. The analysis identified eight primary barriers to digital inclusion in Africa, each representing significant challenges to achieving equitable access and effective use of digital technologies across the continent.

They include digital illiteracy, insufficient ICT infrastructure, cost and accessibility, limited Internet connectivity, rural-urban disparity, Internet crime, computer phobia, and illiteracy and language barriers. The eight barriers discussed in this article were derived organically from a thematic analysis of the reviewed studies. Table 3 below summarises the number of studies (out of 30) in which each of the eight barriers was observed, along with its percentage.

Table 3
Frequency and percentage of identified barriers to digital inclusion ($N = 30$ studies).

Barrier	Frequency (out of 30)	% mention
Digital illiteracy	26	86%
ICT infrastructure	24	79%
Cost and accessibility	21	71%
Internet connectivity	19	64%
Rural–urban disparity	17	57%
Internet crime	15	50%
Computer phobia	13	43%
Illiteracy and language barriers	11	36%

3.1. Digital Illiteracy

One of the barriers to digital inclusion revealed by the analysis is digital illiteracy [37, 51]. Digital illiteracy is treated here as distinct from general illiteracy, as it specifically refers to deficits in technical and operational competencies required to use digital technologies, rather than the absence of basic reading and writing skills. Digital illiteracy was highly mentioned in the reviewed literature. Thus, almost all the papers mentioned this barrier. According to scholars, the digital divide in Africa has been narrowed down to a limited/inability to engage and navigate digital technologies due to digital illiteracy [2, 48, 61, 64]. One of the key issues the region faces is that many people in Africa cannot perform specific operations on smartphones, computers, tablets, or other devices, or navigate the Internet [16, 67]. Despite rising Internet penetration across the continent, a substantial usage gap – estimated at nearly 60% – persists [31], highlighting the disparity between access and meaningful digital engagement.

Studies indicate further that in most African countries, approximately three in ten individuals (31%) use their mobile phones and the Internet at least several times per week. Digital literacy is widespread in Mauritius, Sudan, South Africa, Gabon, Tunisia, and Morocco, with 50% of the adults in these countries. However, in Madagascar, Niger, and Mali, less than 10% of the adults have the required basic digital skills [46]. This suggests that most Africans are digitally illiterate [80]. It is argued that the deficiency highlighted here stems from limited access to digital education and training resources. Many African schools are ill-equipped to integrate ICT into their curricula [18, 44, 53]. Thus, students in these schools go through their school years ill-prepared for the modern world [10]. It is further argued that those who use technology little in the early stages of their development cannot cope with change, thereby widening the gap further.

Currently, most services can be accessed online at the fingertips [56]. Given this reality, one can argue that digital illiteracy is the main barrier to people using digital services at home to enhance their quality of life, including e-learning platforms, e-commerce, and digital healthcare. Also, digital illiteracy arguably limits equal economic possibilities because most of today's occupations involve basic to advanced knowledge of ICTs. It is therefore becoming mandatory, through structured programmes in schools, communities, and workplaces, to eradicate such illiteracy.

However, it is noted that Africa's digital illiteracy problem requires a multifaceted approach that incorporates community involvement, infrastructure, and education. Integrating digital literacy into the formal education curriculum at all levels is one of the best ways to guarantee that children acquire critical skills at a young age [41]. In both urban and rural areas, governments and develop-

ment partners can establish community-based digital learning centres that offer accessible training programmes for adults and out-of-school children. Additionally, mobile technology – widely used across the continent – provides a scalable, cost-effective platform for delivering digital education through mobile applications and SMS-based learning resources, particularly when delivered in regional languages to enhance inclusivity and comprehension. Public-private partnerships may also strengthen these initiatives by contributing resources, knowledge, and technology [84]. To change attitudes and demonstrate the real advantages of digital skills in daily life, awareness campaigns are recommended. When taken together, these actions can strengthen communities and individuals, bringing digital inclusion to all in Africa.

3.2. Insufficient ICT infrastructure

During the data analysis, insufficient ICT infrastructure ranked second among the factors given greater weight in the reviewed documents [15, 23, 24, 36, 47, 64, 65, 80]. Studies indicate that most African countries face insufficient ICT infrastructure [10]. A reliance on reliable Internet connections, sufficient electricity, and affordable computers remains a luxury in many African countries. According to reports, by 2021, almost 567 million people in Africa had no access to electricity. Although Africa has 60% of the world's best solar resources, only 1% of solar generation capacity is utilised [4].

It is argued that if solar energy sources were effectively harnessed, the electricity supply would no longer be a significant issue in Africa. Reliable electricity is a prerequisite for Internet connectivity, making its absence one of the major barriers to digital inclusion on the continent. In addition to electricity, Internet access also depends on the availability of communication infrastructure, such as fibre-connected communication towers, which remain limited in many regions. Regarding digital infrastructure, it is reported that only 28.5% of individuals in Sub-Saharan Africa live in households with Internet access [78]. This means that almost 70% of Africans have no access to the Internet. ATU has also estimated that broadband penetration in Africa is the lowest globally, thus by 2023 only 12% of African households had fixed broadband [3].

Evidence shows that Africa's existing infrastructure remains inadequate to meet the increased demand for digital services. This limited access to ICT infrastructure is particularly evident in rural areas, where most telecom firms opt not to lay infrastructure due to high costs, even though returns are deemed low. It is therefore suggested that African governments and the private sector place greater emphasis on infrastructure development by exploring innovative technologies such as solar networks and satellite Internet.

Satellite Internet offers a strong alternative in remote areas like those in Africa, where conventional Internet infrastructure, such as fibre-optic cables, is either unaffordable or impractical due to geographic constraints. Low Earth orbit (LEO) satellite constellations, including those operated by Starlink and other providers, may enable remote areas to have dependable, fast Internet [38]. However, this study noted that the initial costs associated with satellite technology (equipment, installation, and subscription fees) remain a major barrier. For this reason, it is argued here that strategic public-private partnerships (PPPs) can be particularly important in addressing the infrastructure challenge [84]. By integrating innovations and efficiencies from the private sector, PPPs can lower infrastructure costs, create favourable policy conditions, and ensure broader access to digital connectivity. Thus, satellite Internet has significant potential to close the digital divide in Africa's most underserved areas when backed by PPP projects.

3.3. Limited Internet connectivity

An Internet connection remains one of the major prerequisites for inclusion in global and African digital systems. Although progress has been made in improving mobile network coverage, many areas across Africa, particularly rural areas, remain out of reach [12, 24, 59, 61]. Although mobile Internet penetration is growing in Africa, it has reached only 27% of the region, and the usage gap remains significant at 60% [31]. This is so because infrastructure is still needed [14]. As mentioned earlier,

the problem affecting most countries is a shortage of cell towers, the lack of fibre-optic connections, and few satellite connections [60, 74].

Internet quality across Africa varies significantly. While a few countries offer reliable, high-speed connections, the majority lack adequate access. In many areas with connectivity, it is often unstable or too slow to support high-end digital applications such as video conferencing, distance learning, and e-health services. This limitation poses a significant barrier to full digital participation and development. From 2017 to 2022, average download speeds in Sub-Saharan Africa almost doubled, from 6.3 Mbps to 11.1 Mbps, yet it remains the lowest of all regions [30]. This study holds that the lack of electricity, sluggish Internet speeds, frequent outages, and essentially antiquated equipment make it difficult to implement digital solutions successfully. To eliminate this barrier, governments need to implement policies that support network rollout plans. Industry stakeholders should establish partnerships to share the costs of infrastructure deployment and to adopt emerging technologies, such as low-Earth-orbit satellites, to help connect hard-to-reach and underserved regions.

3.4. Internet crime

This study found that many older Africans are hesitant to use the Internet due to concerns about cybercrime. Internet crime, including phishing, identity theft, online fraud, and ransomware attacks, is one of the wide-scale threats in the digital world. The 2017 statistics indicate that cybercrime cost the economies of African countries an estimated U.S. $3.5 billion [86]. For example, Nigeria, the largest Internet user population in West Africa, was estimated to lose over U.S. $13 billion annually due to cybercrime. Cybercriminals' continuous development of techniques contributes to a climate of suspicion and distrust among potential and existing users of digital technologies. For individuals in Africa who are already hesitant to embrace modern technology, particularly older adults, the fear of falling victim to cybercrime serves as a significant deterrent to engaging in the digital space [43, 64, 87].

Similarly, due to general unfamiliarity with digital safety practices, older adults may avoid online banking or e-commerce out of fear of losing money or having their identities stolen [37]. Additionally, African small business owners who lack the resources to invest in cybersecurity measures effectively may also resist adopting digital tools because they perceive the risks outweigh the benefits [26]. This hesitation limits their personal and professional growth and contributes to a broader digital divide in society.

Furthermore, media reports of significant data breaches and other online fraud increase public concerns about the Internet's security. These incidents erode confidence and trust in using digital platforms, making people who might otherwise become online users hesitant to do so [43]. The resulting exclusion is particularly pronounced among vulnerable populations who lack the knowledge or support to manage cybersecurity risks effectively. To address this, governments and relevant organisations must intensify awareness-raising campaigns on digital safety. Building customer confidence through robust legal frameworks and protections in digital markets is essential. Additionally, fostering positive user experiences with technology can play a crucial role in reducing fear and reluctance to engage with digital technologies.

3.5. Computer phobia

Another critical barrier to digital inclusion is computer phobia, the irrational fear or anxiety associated with using computers and related technologies. In this study, the analysis indicates that some individuals found it difficult to be included digitally due to computer phobia [8, 64]. While often hidden, this psychosocial factor impacts different African demographics [77]. However, it is certainly more pronounced among older individuals and those with limited prior experience with technology [28, 92]. In general, such a phobia has roots in several intertwined causes such as fear of failure, low self-confidence, and, surely, terrible experiences with computer use [32]. For example, people who

are unable to cope with software complexity may have had severe aversions to working on computers for many years. Self-exclusion due to the above may exacerbate feelings of inadequacy and isolation.

Nowadays, even opportunities in education and the professions are increasingly dependent on one's computer skills. So, computer phobia is an enormous disadvantage (Msoroka & Ndibalema, in press). Students who do not use computers may miss out on important learning opportunities, and job seekers with low digital skills may face reduced employability. In other words, computer phobia not only limits access to digital tools but also contributes to greater social and economic inequalities.

This study argues that addressing computer phobia in Africa requires multiple interventions, including educational, psychological, and social strategies. It is further argued here that introducing computers and digital tools early in the education system, and using hands-on, play-based learning, can be one of the best ways to demystify technology and build confidence in ICT from an early stage [20]. Community training programmes for adults and out-of-school youth should create a supportive and non-intimidating environment where participants can learn at their own pace without fear of failure or judgment [79]. Peer mentorship, in which students receive guidance from empathetic and understanding teachers, can also help lower anxiety and foster trust in the educational process. Also, technology should be made more accessible by integrating culturally relevant content and using local languages in digital training materials.

3.6. Illiteracy and language barriers

As previously noted, in today's digital world, access to technology is a fundamental requirement for active participation in education, employment, healthcare, and social interaction. However, digital inclusion – the extent to which individuals and communities can access and effectively use digital technologies – remains unevenly distributed globally. Among the key barriers to achieving digital inclusion are illiteracy and language barriers, which continue to hinder equitable access to and engagement with digital tools and platforms. These factors profoundly influence individuals' capacity to navigate and benefit from digital tools and resources. The two have been discussed in detail in the following subsections.

3.6.1. Illiteracy

Illiteracy is the critical barrier to digital inclusion [25, 64]. Reading and writing are the pre-skills needed to engage with almost all digital platforms. Setting up devices, understanding instructions, accessing information, and communicating online are all literacy-dependent activities. An estimated 763 million adults worldwide lack the basic ability to read and write [40], and 72% of them are found in Africa [5]. This drawback limits their ability to interact with web resources and, thus, prevents them from fully being part of an increasingly digitised world [37].

Although Africa is said to have the largest illiterate population, countries across the continent experience different illiteracy rates. For example, Seychelles leads in literacy rates in Africa with 96%, followed by Sao Tome and Principe (94%) [6]. However, most countries have the lowest literacy rates. For instance, the least 10 countries are Niger (19%), Guinea (30%), South Sudan (32%), Mali (33%), Central African Republic (37%), Burkina Faso (38%), Benin (38%), Chad (40%), Cote d'Ivoire (43%), Liberia (48%), Sierra Leone (48%), and Ethiopia (49%) [71]. This indicates that illiteracy is a problem in Africa.

The current digital interface, website, apps, and software operate predominantly based on text. Even though various tools incorporate audio and visuals to assist non-literate users in working on such platforms, many platforms still lack these features or have underdeveloped them. Limited literacy, therefore, shuts people out from online higher education, digital banking, and e-government services [37, 64]. Thus, illiteracy nurtures poverty and keeps the cycles of social marginalisation going, pushing the edges of the digital divide even further.

3.6.2. Language barriers

Language is another major factor impeding digital inclusion in Africa [25, 37]. The language barrier is particularly pronounced in regions with high linguistic diversity and an underdeveloped digital literacy infrastructure. In many parts of Africa, for instance, people commonly speak multiple local languages that are rarely represented in digital formats. This lack of linguistic inclusivity limits access to digital content and services, further marginalising communities that rely on indigenous or minority languages [88]. Most online websites and other digital services are developed in the dominant world languages such as English or French. Thus, a significant part of the population cannot understand this information. For illiterate or semi-literate people, navigating text-based interfaces is nearly impossible. Thus, it becomes a challenge that they cannot overcome. This lack of linguistic inclusivity has consequences for their access to educational content, government resources, and economic opportunities.

Statistics indicate that English dominates the Internet, accounting for more than 49.3% of the Internet [88]. Several African nations have used English as an official language due to colonial influence. Across the African continent, which has an estimated population of 1.2 billion, only about 6.5 million individuals are native English speakers. However, consistent with global trends, a significant number of Africans have adopted English as a second language. It is estimated that approximately 237 million people in Africa communicate in English, including both native and non-native speakers [49]. This leaves out 963 million people as non-English speakers. This linguistic disparity further marginalises the speakers of less widely used languages and dialects, thus creating substantial accessibility challenges. It is argued here that those who do not speak or understand the dominant language of digital technology (English) may feel excluded and irrelevant. While machine translation tools and multilingual interfaces have improved, they often result in poor or culturally insensitive translations. Besides, most indigenous and minority languages are not supported at all in digital platforms, excluding whole communities from the possibility of digital participation. These challenges can be mitigated by developing localised digital content in indigenous languages and integrating voice-operated and audio-visual tools to enhance accessibility. Additionally, expanding literacy programmes – particularly adult education initiatives – plays a crucial role in improving individuals' capacity to engage with and comprehend the transformative impact of modern technology.

3.7. Rural-urban disparity

One cause of the digital divide in Africa is the rural-urban divide. One of Africa's main disparities between rural and urban areas is access to digital infrastructure. Urban centres generally have high-speed Internet, reliable electricity, and wide mobile network coverage, enabling people to engage with digital technologies. On the other hand, these basic preconditions are mostly absent in rural areas [37, 61, 66, 68]. For instance, Internet access is 47% in urban areas and only 12% in rural areas, meaning computer access is also significantly lower in rural areas than in urban areas.

The likelihood of owning a computer is approximately 5 times higher in urban areas than in rural areas, with access rates of 21% for urban residents compared to just 3.5% for rural residents. In contrast, the disparity between phone access among urban and rural residents is much smaller, with 86% of Africans having access to a phone in urban areas and 69% in rural areas [78].

This lack of infrastructure in rural areas is further exacerbated by the higher costs of deploying and maintaining the technology in those sparsely populated regions [68]. For example, deploying broadband infrastructure into remote areas requires an immense investment that many governments and private firms are unwilling to make because of the low returns expected. This unpalatable reality leaves rural communities cut off from the digital world and its accompanying benefits.

Even when digital infrastructure is available, affordability remains a significant barrier, particularly in rural areas. The cost of Internet services, mobile devices, and computers is disproportionately high relative to the income levels of rural residents [7, 30]. While urban dwellers benefit from competitive markets that drive down prices, rural areas are often served by monopolies or a limited number of

providers, resulting in higher service costs. Moreover, rural communities typically have less access to digital literacy training and technical support compared to their urban counterparts [37]. This skill disparity deepens the digital divide since rural dwellers are less able to use available technologies effectively.

3.8. Cost of ICT services and accessibility

The most significant barrier to digital inclusion in Africa is the cost of ICT services [24, 37]. Many people on the continent continue to find the Internet, mobile data, and telecommunications services very expensive. Indeed, Alliance for Affordable Internet [9] ranks many African countries among the highest globally in mobile data costs relative to income levels. In many countries, a gigabyte (1 GB) of data costs more than 10% of an average monthly income, well above the United Nations' affordability threshold of 2%. Several factors contribute to the high cost of ICT services in Africa. First, the limited availability and high cost of the infrastructure required to deliver these services, such as undersea cables, data centres, and cell towers [21, 31]. This challenge is particularly pronounced in Africa, where vast, sparsely populated rural areas make it economically unviable for private-sector providers to expand network coverage without substantial public investment or government subsidies.

Second, the lack of competition among service providers often creates monopolistic or oligopolistic market conditions, driving prices up. Regulatory environments in many countries do not encourage competition or the passing down of reduced operational costs to consumers [54]. Due to this reality, essential digital services are unaffordable to millions of Africans, thus effectively excluding them from the digital economy. Most Africans cannot afford a smartphone or computer to access the digital world. Even if they can, there is also a lack of local manufacturing and reliance on imports, which mainly results in high prices. Taxes and tariffs on electronic devices further push prices higher, making them unaffordable, especially for low-income households.

Statistics indicate that, on average, in most African countries, only one in five adults (20%) has access to a smartphone and a computer; 43% of adults have access only to a basic cell phone. Mauritius, at least, has achieved the best in Africa in terms of accessibility to ICT services. In one of the leading African countries for digital device ownership, 51% of the population owns both a smartphone and a computer, 27% own either a smartphone or a computer, and 20% own a basic phone without Internet access or a computer. Only 2% of the population does not own any digital device. Morocco ranks second, with 40% of its population owning both a smartphone and a computer, 27% owning either one, 30% owning only a basic phone, and just 2% owning neither a phone nor a computer. Niger and Malawi are the worst. In Niger, for instance, only 4% of its population owns a smartphone and a computer; 11% own a smartphone or a computer; 60% own a phone (no Internet or computer), while 25% of its population owns neither a phone nor a computer. In Malawi, only 4% of its population owns a smartphone and computer; 18% own a smartphone or computer; 38% own a phone (no Internet or computer), while 40% of its population owns neither a phone nor a computer [46].

4. Conclusion and recommendations

This systematic review identifies the key barriers to digital inclusion in Africa by addressing the central research question: *What are the barriers to digital inclusion in Africa?* Based on the findings, this study concludes that several significant and interconnected barriers exist, including digital illiteracy, inadequate ICT infrastructure, limited Internet connectivity, Internet crime, computer phobia, illiteracy and language barriers, rural-urban disparities, and the high cost and limited accessibility of ICT services. Effectively addressing these barriers requires a multifaceted approach involving infrastructure development, digital literacy initiatives, policy reforms, and inclusive technological solutions. However, this study notes that the eight barriers highlighted do not carry equal weight. Based on the reviewed documents, Africa is more affected by the insufficiency of ICT infrastructure. This has been mentioned as a leading barrier to digital inclusion in Africa.

To effectively address the identified barriers, this study recommends integrating digital inclusion as a core component of national development plans. Like essential services such as water and electricity, digital access should be recognised as a fundamental need and a right. The findings highlight the need for tailored, data-driven policymaking to ensure public policy interventions are both effective and contextually relevant. A one-size-fits-all approach is unlikely to succeed; instead, policymakers must rely on country- and region-specific data to inform their strategies. Regulatory reforms may also be required, including the establishment of universal service funds, equitable spectrum allocation, and cost regulation measures to promote fair and inclusive access to digital services. Notably, achieving digital inclusion is not merely a technological challenge but a socioeconomic imperative. More coordinated efforts must be made to overcome these challenges involving governments, the private sector and civil society. By addressing these barriers through collaborative efforts, African nations can harness the transformative potential of digital technologies to bridge the digital divide and advance inclusive development. Achieving digital inclusion requires sustained commitment, innovative strategies, and coordinated action to ensure that all segments of society equitably share the benefits of the digital age.

5. Limitations

This study involved only articles retrieved from Dimensions Scientific, ERIC and Google Scholar databases. This excludes other relevant articles indexed in Scopus, Web of Science, and other specialised repositories. Also, this study included only open-access articles. This excludes articles published in closed-access journals.

6. Future research

This study was limited to open-access articles. Future research should consider including both open- and closed-access to enhance representativeness. The current study used the Dimensions Scientific, ERIC, and Google Scholar databases; a future study should also include articles indexed in Scopus and Web of Science.

Conflicts of interest

The author reports no competing interests.

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Data availability statement

The reviewed articles are listed in appendix B.

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A. Mixed Methods Appraisal Tool (MMAT)

Table 4
Mixed Methods Appraisal Tool (MMAT).

Category of study design	No.	Methodological quality criteria	Yes	No	Can't tell
Qualitative	1	Are there clear research questions?			
	2	Do the collected data allow for the research questions to be addressed?			
	3	Is the qualitative approach appropriate to answer the research question?			
	4	Are the qualitative data collection methods adequate to address the research question?			
	5	Are the findings adequately derived from the data?			
	6	Do data sufficiently substantiate the interpretation of results?			
	7	Is there coherence between qualitative data sources, collection, analysis and interpretation?			
Quantitative	1	Are there clear research questions?			
	2	Do the collected data allow for the research questions to be addressed?			
	3	Is the sampling strategy relevant to address the research question?			
	4	Is the sample representative of the target population?			
	5	Are the measurements appropriate?			
	6	Is the risk of non-response bias low?			
	7	Is the statistical analysis appropriate to answer the research question?			
Mixed	1	Are there clear research questions?			
	2	Do the collected data allow for the research questions to be addressed?			
	3	Is there an adequate rationale for using a mixed methods design to address the research question?			
	4	Are the different components of the study effectively integrated to answer the research question?			
	5	Are the outputs of the integration of qualitative and quantitative components adequately interpreted?			
	6	Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?			
	7	Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?			
Quantitative randomised controlled trials	1	Are there clear research questions?			
	2	Do the collected data allow for the research questions to be addressed?			
	3	Is randomisation appropriately performed?			
	4	Are the groups comparable at baseline?			
	5	Are there complete outcome data?			
	6	Are outcome assessors blinded to the intervention provided?			
	7	Did the participants adhere to the assigned intervention?			

B. Reviewed articles

Table 5: Reviewed articles.

S/N	Author	Year	Article	Journal
1	Livingston et al. [48]	2023	Global student perspectives on digital inclusion in education during COVID-19	Global Studies of Childhood
2	Reddick, Abdelsalam and Elkadi [76]	2012	Channel choice and the digital divide in e-government: The case of Egypt	Information Technology for Development
3	Magesa and Jonathan [51]	2022	Conceptualizing digital leadership characteristics for successful digital transformation: The case of Tanzania	Information Technology for Development
4	Marais [52]	2023	The development of digital competencies in pre-service teachers	Research in Social Sciences and Technology
5	Carmody [19]	2025	'Digital provide' or product consumption diffusion cycle? The diffusion impact and potential of digital technology in the Global South	Information Technology for Development
6	Heeks [35]	2022	Digital inequality beyond the digital divide: Conceptualizing adverse digital incorporation in the global South	Information Technology for Development
7	Dasuki and Effah [24]	2022	Mobile phone use for social inclusion: The case of internally displaced people in Nigeria	Information Technology for Development
8	Babalola and Genga [12]	2024	Managing digital transformation in African higher education institutions: Challenges and opportunities	International Journal of E-Learning & Distance Education
9	Huang et al. [36]	2024	Global understanding of smart education in the context of digital transformation	Open Praxis
10	Adarkwah [1]	2021	An outbreak of online learning in the COVID-19 outbreak in Sub-Saharan Africa: Prospects and challenges	Global Journal of Computer Science and Technology
11	Nwokeocha [61]	2021	Impact of Covid-19 on Teaching and Learning in Africa Assessed by the Education Unions	Journal of Education and Learning
12	Adedokun and Zulu [2]	2022	Towards digital inclusion in South Africa: The role of public libraries and the way forward	Interdisciplinary Journal of Economics and Business Law
13	Akpojotor [8]	2024	Computer self-efficacy, computer anxiety and information retrieval skills as correlates of electronic library use among LIS undergraduates in Southern Nigeria Universities	Library Philosophy and Practice (e-journal)
14	Arendse and Van Den Berg [10]	2024	Exploring the barriers to digital financial inclusion amongst businesses in the informal sector	IST Africa
15	Bolaji and Adeoye [15]	2022	Accessibility, usability, and readiness towards ICT tools for monitoring educational practice in secondary schools in Ilorin Metropolis	Indonesian Journal of Multidisciplinary Research
16	Bornman [16]	2012	The Mobile Phone in Africa: Has it become a highway to the information society or not?	Contemporary Educational Technology

S/N	Author	Year	Article	Journal
17	Deen-Swarray [25]	2016	Toward digital inclusion: Understanding the literacy effect on adoption and use of mobile phones and the Internet in Africa	Information Technologies & International Development
18	Ebrahim and van den Berg [27]	2024	The barriers to technology adoption among businesses in the informal economy in Cape Town	South African Journal of Information Management
19	Faloye, Ranjeeth and Ako-Nai [28]	2022	Understanding age differences in technophobia: A South African case study	South African Computer Journal
20	Kiwonde [44]	2024	The use of ICT in Tanzanian secondary schools: Experienced obstacles in the teaching and learning processes	Journal of Issues and Practices in Education
21	Kweka and Ndibalema [47]	2018	Constraints hindering the adoption of ICT in government secondary schools in Tanzania: The case of Hanang District	International Journal of Educational Technology and Learning
22	Mathevula and Uwizeyimana [53]	2014	The challenges facing the integration of ICT in teaching and learning activities in South African rural secondary schools	Mediterranean Journal of Social Sciences
23	Okocha and Dogo [66]	2023	Digital inclusion in rural areas: qualitative exploration of challenges faced by people from isolated communities in Southern Kaduna	ASRIC Journal on Social Sciences and Humanities
24	Olanrewaju et al. [68]	2021	Left behind? The effects of digital gaps on e-learning in rural secondary schools and remote communities across Nigeria during the COVID-19 pandemic	International Journal of Educational Research Open
25	Schlebusch [77]	2018	Computer anxiety, computer self-efficacy, and attitudes towards the Internet of first year students at a South African university of technology	Africa Education Review
26	Sun, Liu and Lu [80]	2023	Digital literacy in Africa: Exploring its relationship with infrastructure, policy, and social inequality	African Journalism Studies
27	Vitus [87]	2023	Cybercrime and Online Safety: Addressing the challenges and solutions related to cybercrime, online fraud, and ensuring a safe digital environment for all users – A case of African States	TIJER - International Research Journal
28	Yunus et al. [92]	2016	Computer phobia among adult university students	International Journal of Applied Linguistics & English Literature
29	Bekele [14]	2021	COVID-19 and Prospect of Online Learning in Higher Education in Africa	Journal of Comparative & International Higher Education
30	Okello, George and Mbotela [65]	2020	An investigation into availability of ICT infrastructure and adequacy of ICT technical personnel for implementation of digital literacy programme in public primary schools in Waitaluk Division, Trans-Nzoia County, Kenya	Journal of Research Innovation and Implications in Education