

## **Examining Digital Technology's Impact on Equitable Access to Education in Public Higher Institutions: A Systematic Review**

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### **ABSTRACT**

The purpose of the review is to establish the role of Digital Technology in Promoting Equitable access in Education in public higher institutions. The review adopted a structured review approach; we explored the existing peer-validated sources on the role of digital technology in promoting equitable access in education in public higher institutions. Specifically, we reviewed the role of computers, internet and mobile phones availability in promoting equitable access in Education in higher institutions. The review highlights that digital resources play a crucial role in making educational materials more accessible for students with special needs. Assistive technologies such as screen readers, speech-to-text software, and other adaptive tools support learners with visual, auditory, or motor impairments in engaging with course content. However, policies governing ICT integration have raised concerns about the quality of teaching and learning through digital means, particularly regarding equity in comprehension, adaptation, and the alignment of education systems with evolving technological advancements. These concerns became more pronounced during the COVID-19 pandemic, which rapidly accelerated the use of digital tools in education and sparked discussions about the broader implications of digitalization. Findings from the review indicate that the incorporation of digital technology in higher education institutions extends beyond facilitating equal access to skills for students—it also influences various institutional dynamics and impacts multiple stakeholders.

**Key Words:** *Digital technology, Education, Equitable access*

### **I. INTRODUCTION**

Achieving meaningful educational reform is crucial for laying the foundation of long-term economic development, and this hinges largely on fair access to higher education, a central driver of sustainable progress (GN et al., 2024). Advancing equity in higher learning demands a multifaceted approach—tackling systemic obstacles and implementing inclusive policies to ensure students from all backgrounds can thrive (GN et al., 2024). At present, the higher education landscape in Africa continues to face significant challenges and may require more time to reach stability and broaden equitable access. Girls from low-income families, in particular, remain disproportionately affected by gender-based barriers.

As technology becomes increasingly embedded in daily life around the globe, its capacity to enhance fair access to education remains a pressing concern—especially where it falls short of resolving deep-rooted inequalities. By the late 20th century, higher education gained recognition as a vital tool for addressing societal disparities and supporting development efforts. In response, the United Nations prioritized inclusive, high-quality education for all (Okello-Obura, 2010), championing initiatives such as the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs) established in 2015.

A key target within the SDG agenda is to ensure that by 2030, everyone—regardless of gender—can access affordable and quality technical, vocational, and tertiary education, including at the university level (UN, 2015, p. 19). This goal aligns with the 1948 Universal Declaration of Human Rights, which states that higher education should be equally accessible based on ability (UN, 1948, Article 26). Similarly, the 1976 International Covenant on Economic, Social and Cultural Rights echoes this position, advocating for fair entry to higher education through merit-based admissions and a gradual move toward free access (UN, 1976, Article 13, 2c).

Higher education is widely viewed as a cornerstone of progress, as it empowers individuals while contributing to overall societal well-being (Odaga, 2019). Yet challenges remain across Africa, where gender imbalances and structural limitations continue to limit fair participation in tertiary education. Although higher education has expanded in many developing nations, female enrollment continues to lag behind that of their male counterparts. This systematic review investigates the role of digital tools—such as computers, mobile phones, and internet access—in improving educational equity at the higher level, guided by a set of key research questions.

## **Review Questions**

Below are the guiding research questions for the comprehensive review:

RQ1. What is the role of computers availability in promoting equitable access in Education in public higher institutions?

RQ2. What is the role of internet availability in promoting equitable access in Education in public higher institutions?

RQ3. What is the role of mobile phones availability in promoting equitable access in Education in public higher institutions?

## **II. METHODOLOGY**

This portion of the study describes the methodological design followed during the systematic review, outlining the deliberate steps taken to identify, analyze, and consolidate pertinent scholarly material. The research adopted a systematic review strategy, emphasizing a methodical investigation into existing literature on a well-defined subject. This approach involves organizing, analyzing, and synthesizing published findings in order to generate comprehensive and evidence-based insights (Sauer & Seuring, 2023). Data was drawn from prior academic work, assessed and interpreted carefully, and then synthesized through an evaluative process that included critical description, analysis, and summary (Sauer & Seuring, 2023).

The methodology followed the structure of Gough's nine-stage model (Gough, 2007), further elaborated by Bearman and collaborators. This framework requires clearly formulated inclusion and exclusion rules, alongside systematic procedures for searching and filtering results. Major education-focused databases—including ERIC, Scopus, and Web of Science—were used to source literature using targeted search phrases and citation tracking techniques that explored both reference chains forward and backward. Google Scholar served as an additional search tool to expand the literature base.

The review concentrated on academic works published from 2010 through 2024. It drew from peer-reviewed sources such as meta-analyses, policy briefs, review articles, and position papers found in key databases (Scopus, ERIC, Web of Science, and others). Supplementary materials relevant to themes like digital learning tools, educational inclusion, and access equity were also considered.

## Keywords

The keywords applied in this review included terms such as ‘Digital technology’, ‘Computers’, ‘Internet’, ‘Smart phones’, and ‘Education Equity and Access’, all narrowed to focus on the context of higher education. Accordingly, a set of precise search criteria was employed across four primary academic databases.

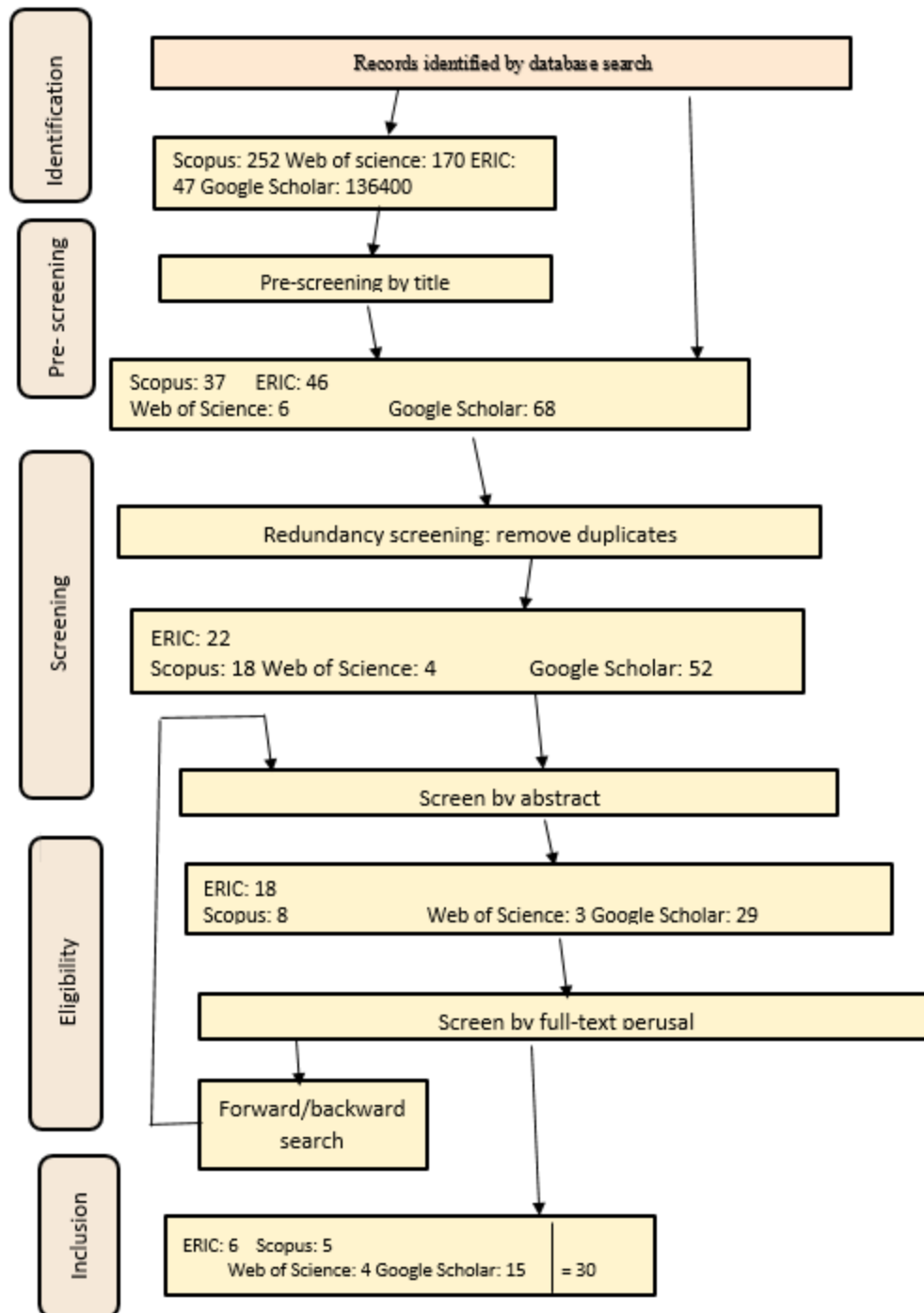
In executing the search within these databases, the initial focus was on identifying studies that explored how various forms of technology support equitable access to education. Search queries included combinations such as “digital technologies” AND “education equity and access”, as well as “ICT” AND “equitable education”. To further hone the results, additional filters were introduced by incorporating terms like “meta-analysis”, “position papers”, “policy papers”, and “systematic review”.

Of particular interest were meta-analyses that offered statistical insights into how digital tools impact education equity. These studies were especially valuable as they provided data-driven conclusions. The total number of results returned from each database is summarized in Table 1.

**Table 1: Overview of Search Results Retrieved per Database.**

| <b>Data base</b>    | <b>Number of results</b> |
|---------------------|--------------------------|
| Education Data base | 422                      |
| Scopus              | 23                       |
| ERIC                | 47                       |
| Web of science      | 6                        |
| Google scholar      | 136400                   |

**Screening Algorithm:** The screening and inclusion algorithm is illustrated in Figure 1.



**Figure 1.** Screening process algorithm.

There was no application of filters based on the education level of participants; both undergraduate and postgraduate students were considered, spanning institutions such as colleges, universities, and vocational training centers. Additionally, the selection process did not

involve restrictions related to the type of tertiary institution or geographical coverage. Given the overwhelming volume of search results obtained via educational databases and Google Scholar, a systematic pre-screening was implemented. This involved reviewing article titles to assess their alignment with the review's objectives. After that, duplicate entries were eliminated to avoid redundancy. Further screening of content was done using abstracts, followed by a full-text examination of the remaining studies. This full-text stage also included a snowballing approach—examining both referenced and citing works to identify additional relevant materials.

The literature searches employed databases like Google Scholar and various education-specific repositories using a range of keywords including “digital technology,” “equity,” “access,” “equitable access,” and “higher education.” An initial pool of 136,869 documents was generated—136,400 from Google Scholar and 469 from education databases. Screening by title reduced the total to 157 documents. A deduplication step narrowed this number to 96. Further filtering through abstract review brought it down to 55, and then, through detailed examination of the full text, citation tracking, and consideration of publication status, the number was finally refined to 30 articles. Only those publications with a strong thematic connection to the use of digital technology in promoting equitable access to higher education were incorporated in the analytical phase.

### **III. Inclusion/Exclusion Criteria**

We had a few criteria for an article to be included or excluded for the research. Table 2 shows the analysis of the eligibility criteria for inclusion and exclusion of articles for the research.

**Table 2:** Inclusion and exclusion criteria for the selection of resources on the role of technology in promoting equitable access to education in high institutions

| <b>Inclusion criteria</b>                      | <b>Number of Documents Included</b> | <b>Exclusion criteria</b>                  |
|------------------------------------------------|-------------------------------------|--------------------------------------------|
| Published in 2010 or later                     | 30                                  | Published before 2010                      |
| Resources on higher education                  | 30                                  | Conference poster papers                   |
| Book chapters                                  | 3                                   | Conference papers without proceedings      |
| Reports from professional/international bodies | 3                                   | Resources on primary and secondary schools |
| Articles in English                            | 30                                  | Other languages                            |
| Peer-reviewed articles                         | 7                                   | Resources on pre-school education          |
| Review and meta-analysis studies               | 10                                  |                                            |
| Position papers                                | 4                                   |                                            |
| Policy papers                                  | 3                                   |                                            |

During the preliminary filtering of entries from Education Databases and Google Scholar, inclusion hinged on whether titles or introductory excerpts incorporated terms like *digital technology*, *computers*, or *Internet*, or clearly aligned with the core research questions (RQ1–RQ3). For instance, studies with titles that referenced themes such as *educational equity* or *access* were allowed to proceed to the abstract screening phase. At that stage, 145 abstracts were assessed using exclusionary criteria; any study that evidently did not correspond with the research questions was omitted, resulting in 96 records advancing to full-text analysis.

To systematically examine and categorize these materials, a matrix was constructed. This organizational tool included a distinct column for each of the three research questions. Any section from a reviewed work that matched one or more questions was extracted and entered into the appropriate column. This allowed for a streamlined, comparative evaluation of the findings tied to each question. Ultimately, after analyzing all 96 full texts, the matrix featured 30 studies identified as offering substantial contributions to answering the specified review questions. These selected articles are listed in Table 3, where their relevance to individual research questions is clearly documented.

**Table 3:** Included work and their contributions to this review

| Work                   | Context    | Theory | Research design, approach | RQ1 | RQ2 | RQ3 |
|------------------------|------------|--------|---------------------------|-----|-----|-----|
| Gray & Lewis, 2021     | U.S.A      | -      | Mixed, Survey             |     | √   |     |
| Edoru & Adebayo, 2020  | Uganda     | -      | Mixed                     |     | √   |     |
| Jacobsen & Joyce, 2011 | -          | -      | -                         |     |     | √   |
| Ahuja, 2023            | -          | -      | -                         | √   | √   |     |
| Kaliisa & Picard, 2019 | -          | -      | Descriptive               |     |     | √   |
| Liang et al., 2023     | -          | -      | Quantitative              |     |     | √   |
| Gazi and Rahman, 2023  | Bangladesh | -      | Quantitative, Survey      | √   | √   |     |
| Abu et al., 2021       |            | -      | Systematic review         | √   | √   |     |
| Moore et al., 2018)    | U.S.A      | -      | None                      | √   |     | √   |
| Cheung & Slavin, 2011) |            | -      | Meta-analytic technique   | √   |     |     |
| Lhamon, 2014           | -          | -      | -                         | √   |     |     |
| Timotheou et al., 2022 | -          | -      | Non-systematic review     | √   |     |     |
| Joy, 2023              | -          | -      | -                         | √   |     |     |
| Harle et al., 2021     | -          | -      | Qualitative               |     | √   |     |
| Bhan, 2011             | -          | -      | Qualitative               |     |     | √   |
| Crystal Weise, 2023    | -          | -      | -                         |     |     | √   |
| Kruppa, 2023           | -          | -      | -                         |     |     | √   |

|                         |          |                                            |               |   |   |   |
|-------------------------|----------|--------------------------------------------|---------------|---|---|---|
| Menschel, 2011          | U.S.A    | -                                          | -             | √ |   |   |
| Higgins et al. , 2012   |          |                                            | Meta-analysis | √ |   |   |
| Epshteyn ,2019          | U.S.A    | Innovation Adoption and Diffusion Theories | Quantitative  | √ |   |   |
| Mann, 2023              | -        | -                                          | -             |   | √ |   |
| Marta Pinto, 2021       | Portugal | -                                          | -             |   | √ |   |
| Sam Goundar, 2011       |          | Grounded theory                            | Case study    |   |   | √ |
| Khazer et al., 2016)    | -        | -                                          | Mixed         |   | √ |   |
| Brown & Haupt           | -        | -                                          | Qualitative   |   | √ |   |
| Singh-Pillay            | -        | TPACK Model                                | -             | - | - | √ |
| Aldhafeeri & Male, 2015 | UK       |                                            | Quantitative  |   | √ |   |
| Zheng, et al., 2016     | -        | -                                          | -             | √ | √ | √ |
| Obura, 2010             | -        | -                                          | Quantitative  | √ | √ | √ |
| GN et al., 2024         | Zimbabwe | -                                          | -             | √ | √ | √ |

#### IV. RESULTS

The results are presented as a summary of the conducted research associated with each one of the posed questions.

RQ1: What is the role of computer availability in promoting education access and Equity in public higher institutions? Proposed role is listed in Tables 4. The most cited roles are improving education outcome, supporting diverse learning and bridging digital divide.

**Table 4:** Computer availability and equitable access to education

| <b>Role</b>                       | <b>Source</b>                                                                                             |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------|
| Bridging the digital divide       | Moore et al., 2018; Gazi and Rahman, 2023; Higgins et al., 2012; Joy, 2023; Ahuja, 2023                   |
| Enhancing learning opportunities  | Abu et al., 2021; Gazi and Rahman, 2023; Menschel, 2011; Ahuja, 2023; Zheng et al., 2016; GN et al., 2024 |
| Supporting diverse learning needs | Abu et al., 2021; Gazi and Rahman, 2023; Timotheou et al., 2022; Higgins et al., 2012; Joy, 2023          |
| Facilitating remote learning      | Gazi and Rahman, 2023; Abu et al., 2021; Ahuja, 2023                                                      |
| Improving education outcome       | Gazi and Rahman, 2023; Cheung & Slavin, 2011; Lhamon, 2014; Epshteyn, 2019; Higgins et al., 2012          |

The table 4 illustrates the multifaceted roles that computers play in promoting equitable access to education in higher institutions, and highlights the diverse reviewed literature through which the role of computers can be secured. It is evident that availability of computers significantly contributes to the leveling the educational playing field, particularly for students from underserved communities. By bridging the gap digital divide, computers enhance learning opportunities, support diverse learning needs, facilitate remote learning and improve education outcome hence promoting equitable access to education in higher institutions.

RQ2: What is the role of Internet availability in promoting education access and Equity in Education in public higher institutions? Proposed role is listed in Tables 5. The far most frequently cited role is enhancing academic performance of all learners and bridging the digital divide.

**Table 5: Internet availability and equitable education**

| <b>Role</b>                                              | <b>Source</b>                                                                                                                                                              |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bridging the digital divide                              | Khazer et al., 2016; Harle et al., 2021; Ahuja, 2023; Brown & Haupt, 2019; Abu et al., 2021; Gazi and Rahman, 2024; Gray & Lewis, 2021; Etoru & Adebayo, 2020; Obura, 2010 |
| Facilitating access to a vast array of digital resources | Gray & Lewis, 2021; Etoru & Adebayo, 2020; Ahuja, 2023; Zheng et al., 2016                                                                                                 |
| Accommodate diverse learning needs                       | Abu et al., 2021; Etoru & Adebayo, 2020; GN et al., 2024                                                                                                                   |
| Enabling remote learning                                 | Gray & Lewis, 2021; Etoru & Adebayo, 2020; Zheng et al., 2016                                                                                                              |
| Enhancing academic performance of all learners           | Aldhafeeri & Male, 2015; Pinto, 2021; Gazi M. Alam and A. Rahman, 2024; Gray & Lewis, 2021; Etoru & Adebayo, 2020                                                          |

Table 5 delineates the roles that the internet plays in promoting equitable access to education in high institutions, alongside the various sources of literature reviewed. The reviewed literature clearly emphasizes that equitable access to internet is fundamental in providing equal educational opportunities to all students, enabling remote learning, and facilitating access to a vast array of digital resources. As such, the role of the internet in promoting equitable access to education cannot be overstated.

RQ3: What is the role of smart phones availability in promoting education access and Equity in Education in public higher institutions? Proposed role is listed in Tables 6. The far most frequently cited role is also enhancing academic performance of all learners and bridging digital divide

**Table 6. Articles reviewed about Mobile phones and education equity and access**

| <b>Role</b>                                             | <b>Source</b>                                                                                                                                                                             |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bridging the digital divide                             | Moore et al., 2018; Singh-Pillay, 2023; Goundar, 2011; Joyce, 2011; Liang et al., 2023; Crystal Weise, 2023; Moore et al., 2018; Kruppa, 2023; Obura, 2010; Zheng et al., 2016            |
| Enhancing academic performance of all learners          | Moore et al., 2018; Singh, 2023; Goundar, 2011; Bhan, 2011; Joyce, 2011; Kaliisa and Picard, 2019; Liang et al., 2023; Crystal Weise, 2023; Moore et al., 2018; Kruppa, 2023; Obura, 2010 |
| Enhancing learning opportunities                        | Goundar, 2011; Liang et al., 2023                                                                                                                                                         |
| Accommodate diverse learning needs                      | Singh-Pillay, 2023; Weise, 2023; Zheng et al., 2016                                                                                                                                       |
| Facilitate communication between educators and learners | Kaliisa and Picard, 2019                                                                                                                                                                  |
| Support digital engagement                              | Liang et al., 2023; Zheng et al., 2016; Singh, 2023                                                                                                                                       |

Table 6 highlights the significant roles that smart phones play in promoting equitable access to education, along with the various sources through which their availability can be secured. It is



evident that smart phones, with their affordability, portability, and connectivity, serve as indispensable tools in leveling the educational playing field. They enable students from diverse backgrounds to access learning resources anytime and anywhere, accommodate diverse learning needs, enhancing academic performance of all learners, facilitate communication between educators and learners, and support digital engagement. Consequently, ensuring equitable access to smart phones is a crucial step in fostering inclusive and equitable education for all students in higher institutions.

## **V. DISCUSSION**

This section examines how digital technologies influence equitable access to higher education, emphasizing their transformative potential while also recognizing the persistent barriers to inclusive learning. According to Cheung and Slavin (2011), the integration of educational technologies within classrooms is expected to expand significantly due to increasing sophistication and affordability—echoing earlier research findings. However, the study emphasizes a notable gap in the volume of randomized trials, signaling a need for more rigorous empirical evaluations. As institutions welcome a growing population of learners with disabilities, enhancing digital accessibility has become a pivotal strategy for improving educational outcomes and addressing disparities in academic attainment.

Although higher education institutions have begun developing frameworks for digital accessibility, there remains a disconnect between these institutional commitments and faculty-level awareness concerning accessibility and disability support (Edoru & Adebayoa, 2019; Epshteyn, 2019). This gap limits the full participation of students with disabilities. Nonetheless, technological advancements offer new avenues for inclusive education by empowering students with special educational needs or language-related challenges to engage more meaningfully in academic life (Joy & Walker, 2023). Tools classified as assistive technology can foster educational equity by leveling the academic playing field.

In regions with limited infrastructure, such as underserved areas of Africa, internet and mobile network services are often scarce or unreliable, posing considerable challenges for accessing online educational materials (Mann, 2023). Information and Communication Technologies (ICTs), however, continue to support learning by fostering collaboration, autonomy, and the development of digital competencies (Pinto & Leite, 2020). Hands-on digital tasks, including coding and content creation, further exemplify the meaningful application of these technologies (Chase, 2024). The findings also reveal that income disparities exacerbate educational inequity, particularly in online learning contexts, where students from wealthier backgrounds enjoy better access to the necessary digital tools and stable connectivity (Abu Talib et al., 2021).

Despite these disparities, equitable access to educational technologies can serve as a mitigating factor in academic inequalities. It is essential for policymakers to promote access to such tools for all learners and educators, alongside providing targeted training to bridge digital divides (Gazi et al., 2024). Infrastructure issues—like bandwidth limitations that surface when large student populations attempt concurrent internet use—continue to pose technical challenges (Gray & Lewis, 2021). For instance, Makerere University has made strides in providing ICT infrastructure, yet gaps persist, necessitating alignment with international standards and adoption of emerging technologies (Edoru & Adebayoa, 2019).

The shift toward mobile teaching and learning demands capacity-building for both instructors and students, fostering innovation in the use of mobile platforms and enhancing cognitive development (Singh-Pillay, 2023). While Makerere University has articulated mobile learning

priorities in policy documents, implementation remains inconsistent. There is an urgent need to revise and operationalize these policies to reflect current technological realities (Kaliisa & Michelle, 2019). Mobile devices can enrich learning experiences and promote inclusivity, but unresolved digital disparities must be addressed to prevent them from becoming exclusionary tools (Gottschalk & Weise, 2023). In lower- and middle-income settings, gender disparities in mobile access persist, with women frequently facing more pronounced barriers. This underscores the necessity for gender-responsive policies aimed at closing the digital gap (Kaliisa & Michelle, 2019). ICT-supported educational strategies have shown promise in expanding opportunities for girls, particularly through mobile learning platforms (Singh & Jain, 2017; Timotheou et al., 2023).

## **VI. LIMITATIONS OF THE REVIEW**

An evident shortcoming in the majority of the reviewed literature is the absence of a clearly defined theoretical framework. Since theories serve as interpretive lenses in research, relying on findings devoid of such grounding may result in distorted interpretations. This highlights the imperative for a study framed within Social Equity Theory, to provide more analytical depth and contextual accuracy.

Most of the prior research employed either a qualitative or a quantitative methodology in isolation. This suggests the need for a dual-strategy design—integrating interpretative and positivist paradigms—to investigate the influence of digital technologies on equitable access to education within public higher education institutions. The synergy of both approaches enables more comprehensive data collection and minimizes the risk of overlooking critical insights. Another significant limitation stems from the geographical context of the literature reviewed. Much of the existing research originates from European contexts, making it less transferrable to Uganda due to considerable differences in digital infrastructure, governmental policies, and socio-economic realities. In fact, some of the sources lacked contextual grounding altogether, calling into question their reliability. These discrepancies reinforce the necessity for context-sensitive research that focuses explicitly on Uganda's public higher education landscape.

Moreover, a distinct gap exists in the literature—none of the studies directly examined how digital technology supports accessibility and equity in higher education, particularly within public institutions. This omission creates a compelling rationale for a targeted study to fill that void. Policy documents reviewed also reveal systemic deficiencies. There are insufficient strategies to make digital tools and internet connectivity affordable across the student body. Furthermore, a lack of holistic policies aimed at establishing stable digital infrastructure—especially in remote and underserved regions—continues to widen the digital divide. Addressing these shortcomings requires a study that advocates for well-defined policies and regulatory frameworks to foster equitable digital access in Uganda's higher learning institutions. Many of the position papers reviewed presented viewpoints rooted in specific institutional or individual perspectives. This inherent subjectivity limited the broader applicability of their findings. Therefore, there is a clear need for impartial, evidence-based research capable of informing inclusive, scalable solutions.

## **VII. CONCLUSION**

In summary, computers are instrumental in facilitating equitable educational access by expanding learning modalities, promoting digital competence, and helping to narrow the gap between socio-economic groups. Nonetheless, unlocking their full potential depends on confronting digital inequities, securing the necessary technological tools, and enacting inclusive educational policies that accommodate all students. Doing so paves the way for a fairer and more inclusive educational environment for generations to come.

Similarly, the internet stands out as a transformative force in broadening access to higher education. Its provision of diverse academic resources, support for distance learning, and ability to connect learners across borders significantly contributes to leveling educational opportunities. Yet, to ensure this potential is realized equitably, it is essential to address infrastructure deficiencies, bridge the digital divide, and implement supportive policy frameworks that guarantee inclusivity. Smart phones, due to their mobility, cost-effectiveness, and internet access capabilities, have become vital in promoting education equity within higher institutions. Their widespread use allows learners from various socio-economic backgrounds to engage with educational materials at any time and location. Institutions can use this to foster inclusive learning environments. However, persistent challenges such as limited digital literacy and inconsistent infrastructure must be addressed to ensure all students benefit equitably from mobile learning technologies.

The integration of Information and Communication Technologies (ICTs) offers great promise in boosting academic achievement and reducing learning inequalities. However, regions with underdeveloped infrastructure still face serious obstacles. Overcoming these hurdles requires collaborative efforts by educators, policy architects, and stakeholders to guarantee equal access to ICT tools and proper training for both learners and instructors. Transitioning to mobile-based teaching and learning entails more than just offering devices; it demands targeted education and support, effective policy enforcement, and a sustained commitment to equity and inclusivity. By approaching these challenges holistically, academic institutions can unlock the full impact of mobile digital innovations, ensuring quality learning and lifelong opportunities for everyone. Strong cooperation in policy, implementation, and inclusive training is key to overcoming barriers and building a more just education system.

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