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Mapping the Landscape of ICT Integration in Education: A Systematic review of Literature

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ABSTRACT
The integration of Information and Communication Technologies (ICT) in education has received considerable attention and interest in the field of education. However, there is a lack of systematic literature reviews that explore the visibility and bibliometric portrait of ICT integration. This article aims to address this knowledge gap by conducting a comprehensive review of existing literature, focusing specifically on the utilization of ICT within slum community schools. A total of 71 relevant articles were identified and subjected to quality evaluation and review consideration. The study follows the Tripartite Model for Systematic Literature Review by Daniel and Harland (2017). The review focuses on articles published between 2012 and 2022 to understand the current state of research on ICT for Education (ICT4E) and its impact on teaching and learning. The examination reveals a scarcity of literature on the influence of inadequate ICT resources on teachers' beliefs and actual utilization of ICT in educational settings. Additionally, there is a lack of research exploring how teachers and students overcome technological obstacles within classrooms. The broader implications of these findings indicate that, without addressing these gaps, educational inequalities may persist, limiting the potential benefits of Information and Communication Technology (ICT) in enhancing learning outcomes, particularly in underprivileged communities. By addressing these issues through targeted research and policy interventions, equitable and effective ICT integration could be ensured across diverse educational settings. These gaps emphasize the need for further investigation into the implementation of ICT4E in Ghanaian public schools.

INTRODUCTION

There is a growing community of research on the use of ICT in education, with studies focusing on various aspects of ICT integration such as its impact on student achievement (Cviko et al., 2012; Palomino, 2017), teacher attitudes and use of ICT (Akbulut et al., 2014; Eickelmann & Vennemann, 2017; Prasojo et al., 2019), and the role of ICT in supporting pedagogical change (Dong & Newman, 2018; Gellerstedt et al., 2018; Goradia, 2018). For instance, research has shown that the use of ICT can improve student achievement and learning outcomes (Khojaye et al., 2014; Lin et al., 2018). ICT can also facilitate collaborative learning, problem-based learning, and experiential learning, which are pedagogical approaches that are effective in promoting student learning (Huang & Chen, 2017; Khojaye et al., 2014). Studies have also shown that the integration of ICTs in education can improve student engagement and motivation, facilitate the acquisition of 21st century skills such as critical thinking and problem-solving, and enhance the effectiveness of teaching (Ertmer et al., 2012). ICTs have the potential to promote the

inclusion of disadvantaged and marginalized groups, such as those living in rural areas or with disabilities, by providing access to educational resources and opportunities that may not be otherwise available (UNESCO, 2016).

While there is consensus on the potential advantages of ICT integration in education, there are also barriers to its effective implementation. These include issues related to access and availability of technology, teacher training and professional development, and the need to align ICT use with educational goals and pedagogy (Cviko et al., 2012). Additionally, there is a need to consider the cultural and context-specific factors that may influence the successful integration of ICT in education (Ertmer et al., 2012; Huang et al., 2021; Siwatu et al., 2017). One of the main challenges is the lack of teacher training and professional development in the use of ICT (Han et al., 2018; Palomino, 2017; Rueda & Cerero, 2019; Zyad, 2016). This could lead to a lack of confidence and competence among teachers in using ICT in their teaching, which in turn can hinder the successful integration of ICT in the classroom. Khojaye et al. (2014) posit that lack of access to ICT resources and infrastructure can be a barrier for students and teachers in underprivileged or rural areas. There is also a need to consider the potential challenges and risks associated with the use of ICTs, such as the digital divide, information overload, and cybersecurity (Khan, 2019). The literature on ICT integration in education suggests that it can bring positive outcomes for teaching and learning, but it is important to carefully consider the context and implementation factors to maximize its potential.

While there has been some research on ICT integration in education in developing countries, there is a lack of studies specifically focusing on the integration of ICT in slum schools (UNESCO, 2016). This is a significant gap in the literature as the integration of ICT in slum schools could potentially have a greater impact on learning outcomes and narrow the education divide between privileged and underprivileged areas. Additionally, the unique challenges faced by slum schools, such as limited resources and inadequate infrastructure, need to be considered when examining the integration of ICT in these contexts (Bird et al., 2017; Byker & Austin, 2014; Nkrumah et al., 2023). A systematic literature review of ICT integration in education for teaching and learning in slum schools would provide valuable insights into the successes and challenges of implementing ICT in these contexts and inform the development of effective strategies for improving the integration of ICT in slum schools. Such a review could provide insight into the current state of knowledge on ICT integration in education and inform policy and practice in this domain.

Systematic literature review on ICT integration in education could contribute to the field by synthesizing existing research and identifying gaps in the literature. This is particularly important given the rapid pace of technological change and the need for evidence-based approaches to guide decision-making (Oliver, 2013). A systematic review could provide a reliable and transparent summary of the current evidence, which could inform policy and practice, and inform future research directions. As such, this article which is part of an ongoing research work on ICT integration in education commenced in 2021 and is aimed at providing a literature map of what has been investigated on the topic with a focus on the immediate past decade. The literature of the last 10 years (2012-2022) could provide the most current research overview on the topic to aid in understanding the nature of studies conducted on marginalized societies and the conceptual, theoretical, and epistemological gaps that exist and require further investigations.

METHODOLOGY

This systematic review approach is to critically evaluate, summarize, synthesize, and evaluate relevant and extant research on the integration of ICT in education. In this review, we also considered the

believe that a well-executed systematic review reduces errors and biases by adhering to a clearly outlined protocol that establishes objectives, review questions, and predetermined methods, ensuring the production of dependable and trustworthy findings (Fink, 2014). The Tripartite Model for systematic reviews by Daniel and Harland (2017) was adopted for this study. The approach is most appropriate for educational reviews as it provides comprehensive information and specificity in the search for relevant literature. The review was also guided by Koehler, Mishra, and Cain (2013) categorization of knowledge domains pertaining to the incorporation of technology in education to conduct a systematic review of a diverse array of literature that explores the crucial role of technology in facilitating and mediating teaching and learning processes and the overall goal of broader provision of life-long learning opportunities for all. This approach is undertaken with the primary objective of offering a comprehensive perspective on how the matters related to the utilization of technology in education have been addressed in current research.

The purpose of the review was to evaluate the merits and shortcomings of various approaches, investigate claims and supporting evidence, recognize common patterns and trends, and establish missing links and relationships between prior research. These aspects were used as guidelines and standards for examining, assessing, and combining existing literature, adhering to the Tripartite Model for systematic literature review (Daniel & Harland, 2017). The Tripartite Model is represented in Figure 1.

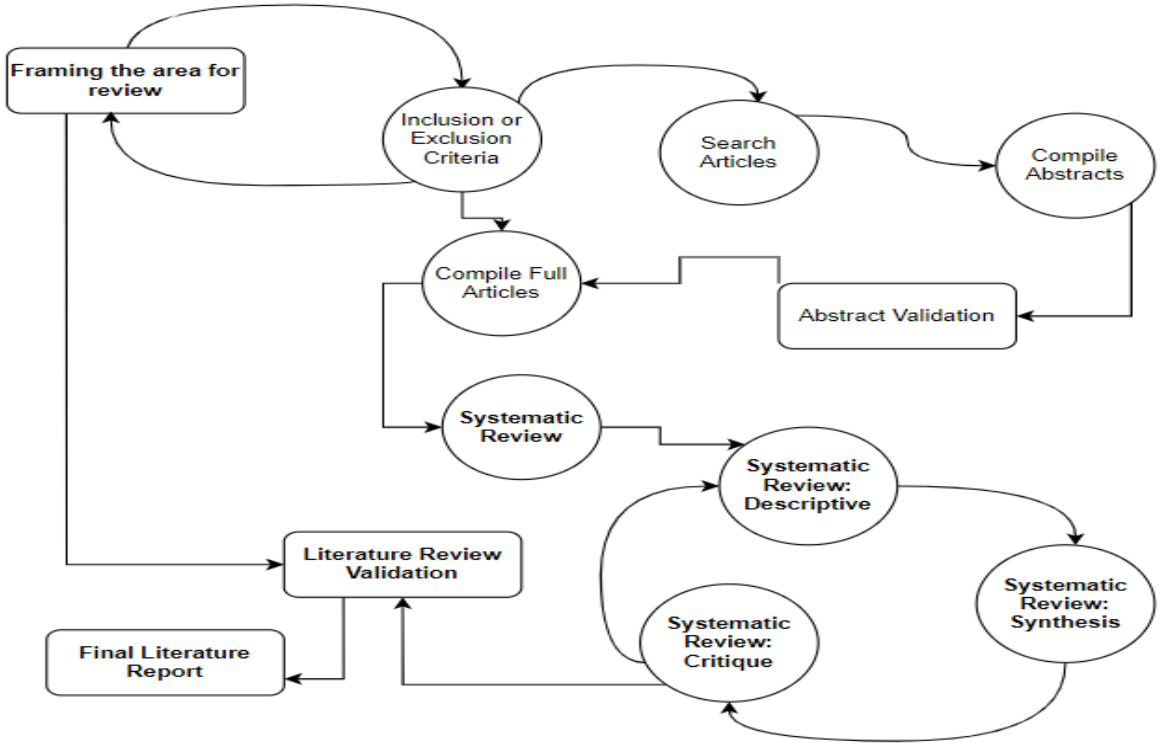

Figure 1. The Review Process for the study: Tripartite Model *(Daniel & Harland, 2017)*

The Tripartite model, extensively employed for meticulous examination of research (Ndukwe & Daniel, 2020), integrates elements from systematic review approaches such as the Cochrane method to present the most trustworthy evidence. This framework comprises three essential elements: descriptive (providing a thorough summary of the literature), synthesis (arranging the research into logical categories based on shared concepts, relationships, and justifications), and critique (assessing the literature, offering supporting evidence, challenging ideas, or suggesting fresh viewpoints). By incorporating these components, it offers a comprehensive outlook and interpretation of the research findings.

One of the key features of the Tripartite Model is its focus on transparency and rigor. The model is designed to be highly structured, with clear guidelines for each step of the process, which can help ensure a thorough and unbiased review. Additionally, the model is flexible, allowing for the use of a range of methods for data extraction and synthesis.

Table 1. Overview of the research question, purpose, and review outcome

SN	Research Question	Purpose	Intended Outcome of the review
1	What are the current discourses about ICT4E?	To investigate contemporary discussions pertaining to ICT4E in scholarly works?	Provide perspectives on the prevailing beliefs of ICT4E research in the existing literature
2	What are the various directions and themes in the ICT4E research in literature?	To contextualize the research direction in literature?	Categorization of ICT4E research on themes settings and methodologies
3	What are the possible research gaps and contradictions present in extant literature?	To reveal potential research gaps for investigations	Demonstrate research gaps and contradictions for ICT4E research

Selection of databases and search terms

The literature review was conducted in phases. The first phase was the extensive search for closely related peer-reviewed publications between 2012 and 2022 in the major scientific databases, namely ERIC, Scopus, Google Scholar, Elsevier, and Science Direct, to gather a comprehensive data set for review. The review search for existing papers was conducted mostly on the Google Scholar site, which indexes work (articles, book chapters, patents, etc.) from various journals and sites, as well as archive repositories.

The literature was subsequently examined by conducting a search using specific keywords or phrases such as: "ICT4E", "ICT and slum schools", "ICT integration in schools", "ICT integration in education", "technology use and slums AND in-service teachers", "ICT use in informal settlements", "ICT and quality education", "ICT in informal settlement schools", "technology use in schools", "technology integration in schools", "ICT use and inclusivity in schools", and "ICT use in marginalised communities". The initial assessment of the title of the article provided a preliminary indication of its relevance to the current study. Subsequently, the complete reference including author(s), year of publication, title of publication, and abstract, were obtained for further evaluation if the title of the article indicated a focus on ICT integration in schools, ICT adoption by teachers, or technology usage in marginalized community schools. To ensure the review was based on up-to-date literature, the search was limited to empirical studies published between 2012 and 2022, encompassing the last decade.

The literature search and analysis comprised publications that offered pertinent information regarding the integration of ICT in schools situated in slum communities, as well as the TPACK framework concerning ICT utilization in schools. The screening process involved assessing the abstracts and titles of results obtained from databases, with a focus on peer-reviewed published studies within the specified time frame that were relevant to the study. The full texts of the selected publications that closely aligned with ICT integration in education, were obtained, and organized using Elsevier's Mendeley Reference Manager. This approach aimed to facilitate easy retrieval of electronic articles, considering that technological advancements have influenced the archiving and organization of academic information.

Applying the inclusion and exclusion criteria

The systematic review focused on incorporating articles that aligned with the research objectives, research questions, research scope, and the specified years for the final analysis. The selection criteria

ensured that only articles meeting these criteria were included. The detailed inclusion and exclusion criteria for the systematic review can be found in Table 2.

Table 2. Summary of article inclusion and exclusion criteria

Inclusion Criteria	***Type***
Published from 2012 to 2022	Publication date
Published in English language	Publication language
Focus on aspects related to technology use in education	Content
Relate to aspects of technology use in schools in slum settings	Content
Peer-reviewed articles, book chapters or theses	Journal
Exclusion criteria	***Type***
Letters, editorials, lecture notes, and textbooks	Research design
Studies related to social support for displaced persons, human rights intervention programmes for marginalized groups, refugees, etc	Content
Studies related to ICT use for administration, academic assessment, etc.	Content

The literature search began with the identification of important databases used by scholars in the field of education and technology. These were the most utilised online storage sites: Google Scholar, ERIC, and the Scopus journal databases. Harzing's Publish or Perish Windows GUI 8th Edition (8.2.3944.8118) was employed to perform searches on Google Scholar, Scopus, Crossref, and Web of Science databases. This software utilized search keywords and phrases to automatically crawl the databases and identify relevant articles.

Keywords and phrases were entered into the databases with various Boolean operators (AND, OR, NOT, AND NOT) combinations to search for articles related articles to the topic. These followed a filtering of the articles using database analytics, reading of the titles of the articles, and then the abstracts of the articles as established from the database searches. These databases were set to ten years (2012-2022) to survey articles within this period to provide the most recent literature on the integration of ICT in education. Additionally, articles from peer-reviewed journals were selected in this review to ensure that only articles that have gone through a rigorous quality evaluation are included in the review. To expand and enhance the search scope and increase the chances of obtaining a comprehensive list of relevant literature, additional search strategies were employed. These strategies included exploring other relevant online sources, conducting citation searches, and examining the reference lists of identified studies.

A total of 71 relevant publications were selected for a systematic review of literature on ICT integration in education. The articles were evaluated for quality and eligibility, considering methodological rigor. Peer-reviewed journal articles were prioritized for inclusion. Some articles were excluded due to focusing on different topics or falling outside the specified date range. After a thorough examination of the 71 papers, a comprehensive literature analysis was completed, classifying them based on research questions, focus, themes, methodology, and countries researched. This provided a condensed but comprehensive literature mapping to identify existing knowledge and research gaps on the topic.

RESULTS AND DISCUSSION

This section of the study provides the findings in a structured manner, divided into four parts. The initial part offers a general overview of the reviewed articles, while the subsequent three parts concentrate on examining the themes, contexts and settings, methodological approaches, research contradictions and findings as outlined in the research questions. The themes and emphases of the reviewed articles are

presented in subsections, including articles that cover topics such as ICT infrastructure and resources, teacher ICT pedagogical skills, and perceptions of ICT, as well as ICT in slum settings. The contextual and geographical perspectives of the review articles are then presented along with the methodological approaches adopted for the study of the articles. The findings derived from the reviewed studies are presented as research that explored or evaluated the use, integration, or benefits and the associated challenges and general issues regarding technology in education. These studies have approached the phenomenon from a variety of angles, settings, and methodologies and could have impacted policy through their findings.

General overview of the articles reviewed

The articles selected for the final analysis and review were peer-reviewed journal articles, theses, and a book chapter and 71.8% (51 of 71) of which focus was on the use of technology in the classroom. The rest of the 71 articles (n = 20) focused on the use of technology in slum settings or socioeconomic challenges in slum communities. None of the articles was a research study on higher education studies. Most of the articles reviewed (66 articles) were based on empirical studies carried out around the world. Four of the selected articles (5.63%) were theses and one (1.41%) was a book chapter. It was also noted that the articles in Africa were from Ghana, South Africa, Kenya, Tanzania, Botswana, Namibia, and Ethiopia. This was of special interest to the authors, as these findings would inform the scope and understanding of research on ICT4E in Africa, particularly in the Sub-Saharan region where technology use is cited low (Asongu & Odhiambo, 2019).

In total, 186 authors were identified with an average of 2.61 authors per article. The highest number of authors identified on a paper was eight. Twenty-seven research articles were identified to focus on the African context and affiliated with African tertiary institutions, five articles were from Kenya (see Eppler et al., 2020; Murithi et al., 2013; Njihia et al., 2021; Piper et al., 2015; Svensson, 2017), five research articles from South Africa (see Chisango & Lesame, 2017; Engelbrecht et al., 2015; Kamalizen & Naidoo, 2018; Mwapwele et al., 2019; van de Werfhorst et al., 2020) and ten from Ghana (Ankrah & Abah, 2020; Buabeng-Andoh, 2019; S. A. Gyamfi, 2017; Karakara & Osabuohien, 2019; Mark & Emmanuel, 2019; Natia & Al-Hassan, 2015; Opoku et al., 2016; Peprah, 2016; Sarfo et al., 2017; Yaw & Acquah, 2012). There were two papers from Namibia (Ngololo et al., 2012; Woyo et al., 2020), a paper each from Tanzania (see Ndibalema, 2014), Botswana (see Mogwe & Balotlegi, 2020) and Ethiopia (see Ergado et al., 2021) and two of the articles (see Ejemeyovwi et al., 2018; Samarakoon et al., 2017) had an African continental scope and four other selected research articles (see Aziz, 2020; Karunaratne et al., 2018; Lim et al., 2020; Mena et al., 2019) had a transnational scope and focus. The articles from other African countries represented 23.9% (n=17) of the review articles indicating a significant research interest in ICT integration in schools. Eighteen of the total review papers (25.4%) had single authors, seventeen papers (23.9%) had two authors and twenty-one papers (29.6%) had three authors. There were fifteen papers (21.1%) with three or more authors, and this was significant to this review given the value and advantage of the author and international collaborative research to science quality (Ivanović & Ho, 2019; Larivière et al., 2015).

Assessment of the themes and focuses of the studies

The goal of the second research question was to provide a literature map on the directions and themes in the ICT4E research. The analysis of the articles revealed various themes and the focus of the literature concerning the utilization of technology in the field of education. First, some articles appear to focus on the availability and use of technology resources in schools and how it affects learning outcomes in schools (see Ampofo & Abigail, 2020; Opoku et al., 2016; Pima & Sedoyeka, 2016). Second, teacher perception, attitudes, and beliefs in the adoption of technologies to facilitate teaching and learning in

schools (see Dube & Scott, 2018; Ghavifekr et al., 2016; Hasala & Kelly, 2020; Kousar & Mahmood, 2015; Prasojo et al., 2019; Ramdeyal, 2014; Recepoglu & Ergun, 2013) was also identified to be the focus of the articles. The adoption and use of technological tools to improve the livelihoods and economy of people in marginalized societies were the focus and purpose of some articles in the literature (Byker, 2014; Goti & Dalawai, 2019; Joshi et al., 2020; Kibere, 2016; Naliaka & Iravo, 2016; Soriano et al., 2018; Svensson, 2017; Wyche, 2015). Another category of articles emphasizes the challenges and barriers to the integration of ICT (Aziz, 2020; Azmi, 2017; Chisango & Lesame, 2017; Ghavifekr et al., 2016; Kasse et al., 2013; Kihoza et al., 2016; Mark & Emmanuel, 2019; Mbodila et al., 2013; Samarakoon et al., 2017; UNESCO, 2015)

The following subsections present a categorization of themes and the focus of the articles. Hence, the three subsections provide a thematic classification of the analyzed articles. However, it is important to note that these categories are not completely distinct, and there may be articles that overlap between them.

Use of ICTs in slum communities

In a cross-sectional survey study, Joshi et al. (2020) explored the disparities in technology access among gender groups in urban slums of New Delhi. The study aimed to examine gender disparities in mobile phone ownership, Internet accessibility, and SMS proficiency among individuals residing in slum areas of India. The research findings suggest that women in slums were less inclined to possess mobile phones compared to men. Moreover, the study emphasizes that age, the number of income-generating members in the household, and individual education serve as predictors for mobile phone ownership, text messaging skills, and Internet access. The authors recommend further research to delve into the underlying causal factors contributing to unequal access to technology among gender groups.

Byker and Austin (2014) examined ICT intervention programs targeting young people living in Indian slums. The qualitative study emphasizes the role of community computing in fostering a critical awareness among individuals in slum communities. Similarly, Engelbrecht et al. (2015) investigate the alignment between educational policies and the practical implementation of inclusive education in South African schools. Both studies contribute to the understanding of the intersection between technology, education, and marginalized communities. Likewise, Karakara and Osabuohien (2019) explored the access to ICT in households and the educational disadvantages encountered by children in Ghana. The study emphasizes the disparities in access and wealth, which tend to perpetuate educational disadvantages and impoverishment among children.

Furthermore, Wang et al. (2019) studied the utilization of technology in rural settings, specifically examining the factors that contribute to variations in the use of digital educational technologies among teachers in Western rural China. The article proposes that the adoption of digital education resources does not seem to be influenced by school-level factors. Nevertheless, the study emphasizes that higher levels of teacher attitudes, knowledge, and skills, along with favourable school contextual factors, age of teacher, and teaching experience, play a significant role in facilitating teachers' utilization of digital educational resources. Sampath Kumar and Shiva Kumara (2018) explored the digital divide in India, focusing on the differences in ICT usage between rural and urban students. The study examined the frequency, purpose, and location of computer use, as well as the challenges faced by students in rural and urban areas when using computers. On the other hand, Chiao and Chiu (2018) investigated how the utilization of ICT mediates the connection between students' socio-economic status and academic performance in China.

Table 3: Summary of publications related to technology use and slum settings

Author(s)	Context/ settings	Topic	Contribution	Research design	Results/Conclusion
Byker (2014)	India	ICT oriented toward Nyaya: Community computing in India's slums	ICT intervention programmes for young people in India's slums.	Qualitative: case study, ethnography	Community computing helps to develop the critical consciousness of people
Soriano, Cao, and Sison (2018)	Philippines	Experiences of ICT use in shared, public access settings in Philippine slums	How privacy and publicness are constructed ICT users on global margins.	Qualitative, Ethnography	User privacy and confidentiality in ICT use in shared public spaces are affected
Sampath Kumar and Shiva Kumara (2018)	India	The digital divide in India: use and non-use of ICT by rural and urban students	Frequency, purpose, and place of computer use and challenges facing rural and urban students' use of computers	Quantitative: questionnaire	20.66 percent of rural students and 69.70 percent of urban students used the computer for various academic purposes.
Quattri and Watkins (2019)	Bangladesh	Child labour and education – A survey of slum settlements in Dhaka (Bangladesh)	Education and child labour in slum settlements	Quantitative	Late entry to school, grade repetition and poor-quality education all serve to push children out of education and into employment.
Njihia, Nkonge, and Nderitu (2021)	Kenya	Determinants of attendance in Alternative Primary Schools in Mathare Slum, Nairobi, Kenya	The influence of home and school-based factors on school attendance	Quantitative	There is a strong positive trend and statistically significant correlation between home background characteristics and pupils' school attendance.
Svensson (2017)	Kenya	Exploring the potential of ICT for informal, non-formal and formal learning in the slums of Nairobi.	Challenges and opportunities with ICT in schools	Qualitative	Less ICT is used in lesson delivery. ICT is used for lesson preparations and assessment
Joshi et al. (2020)	India	Gender and Digital Divide Across Urban Slums of New Delhi, India: Cross-Sectional Study	Examine gender differences in mobile phone ownership, internet access, and knowledge of SMS text messaging among males and females living in urban slum settings	Mixed methods	Females were half as likely to own mobile phones compared to males, less likely to have internet access, or know how to send text messages

The findings indicate that the utilization of ICT for information retrieval and social interaction has the potential to exacerbate achievement gaps resulting from disparities in socioeconomic status. Quattri and Watkins (2019) conducted a survey in Dhaka, Bangladesh, within slum settings to examine the impact of child labour on education. The study reveals that late enrolment in school, grade repetition, and inadequate quality of education contribute to the migration of children from slum areas into employment. Soriano et al. (2018) investigated the experiences of ICT usage in shared public access facilities located in Philippine slum areas. The article focuses on the construction of privacy and publicity by ICT users in marginalized global contexts. Svensson (2017) explores the potential of ICT in facilitating formal, non-formal, and informal learning within the slum settings of Nairobi, Kenya.

Research Context and Settings

Njihia et al. (2021) conducted a study in the Mathare slums of Kenya to investigate the factors influencing attendance in alternative primary schools. Eppler et al. (2020) focused on forcibly displaced individuals in the country and examined their use of ICT tools, assessing the various purposes for which they utilized these technologies. Murithi et al. (2013) examined the influence of school ICT policies on the implementation of computer studies curriculum in secondary schools. Piper et al. (2015) built upon Kenya's ICT policy and explored the effectiveness of tablets and e-readers in enhancing student outcomes.

In Botswana, Mogwe and Balotlegi (2020) examine the obstacles hindering the adoption of ICT in primary schools. They identify the low utilization of ICT, lack of basic ICT skills, and insufficient infrastructure as the primary barriers to the adoption and use of ICT in the primary school system. In Namibia, Ngololo et al. (2012) evaluate the implementation of the National ICT policy for education in rural science classrooms. Woyo et al. (2020) assess the factors influencing the perception of the implementation of the ICT policy in education from a Namibian perspective. In Tanzania, Ndibalema (2014) explored attitudes towards the use of ICT as a pedagogical tool in secondary schools. Karunaratne, Peiris, and Hansson (2018) provide an international perspective on the challenges of implementing ICT projects in developing countries. They evaluate ICT projects in Bangladesh, Cambodia, Liberia, Rwanda, Uganda, Ethiopia, and Tanzania.

In a related study, Mwapwele et al. (2019) examine the ICT support environment in developing countries, specifically focusing on the networks that rural teachers utilize to acquire knowledge and assistance on ICT. Van De Werfhorst et al. (2022) explore the digital divide in online education in South Africa. Their research discusses the inequality in digital preparedness among students and schools prior to the onset of the COVID-19 pandemic. Ejemeyovwi et al. (2018) engage in a discussion on ICT investments, human capital development, and institutions within the Economic Community of West African States (ECOWAS), exploring how ICT could be utilized to transform the economies of ECOWAS member countries.

Table 4. Summary of studies in the Ghanaian context related to ICT in education

Author(s)	Topic	Contribution	Research design	Results/Conclusion
Karakara and Osabuohien (2019)	Households' ICT access and educational vulnerability of children in Ghana	Household access to ICTs and wealth disparity affects the likelihood of a child being educationally disadvantaged or vulnerable	Quantitative methods, secondary data (GDHS, 2014)	Household having access to ICTs at home generally improves the learning outcomes of children.
Adu Gyamfi (2017)	ICT Acceptance in Education: A Study of Pre-service Teachers in Ghana.	Acceptance and integration of ICT into pre-service teacher education	Mixed Methods	The participants expressed positive attitudes towards ICT and recognised it as a prerequisite for teaching and learning in the 21st century.
Yaw and Acquah (2012)	Status of implementation of the ICT Curriculum in Ghanaian Basic Schools	The extent of effective implementation of the ICT curriculum effective implementation in basic schools	Quantitative	Teachers had a positive perception of ICT in primary schools. ICT facilities were woefully inadequate for the teaching
Ankrah and Abah (2020)	Assessment of the Use and Impact of ICT Centres for Digital Inclusion in	The Role, Use, and Impact of Community ICT centres	Quantitative	57% and 30.9% at the two places did not use the centres. Poor ICT policy and poor network connectivity of the centres,

	Ghana			inadequate computers, insufficient working hours, power outages, virus threats and poor computer skills of people were frequently indicated at the centres
Sarfo et al. (2017)	Concerns of Teachers about the Implementation of ICT Curriculum in Basic Education in Ghana	ICT curriculum implementation concerns by teachers	Quantitative	The stages of concerns were not related to their teaching experience
Buabeng-Andoh (2019)	Factors that Influence Teachers' Pedagogical Use of ICT in Secondary Schools: A Case of Ghana	The factors that influence secondary school teachers' ICT usage in schools	Quantitative	Teachers' use of ICT was still restricted to basic and traditional activities such as searching for information, class presentation
Natia and Al-Hassan (2015)	Promoting teaching and learning in Ghanaian Basic Schools through ICT	The extent to in which school administration, teaching and learning are promoted using ICT in Ghanaian Basic Schools	Quantitative	Low number of computers at basic schools. Teachers' ability to use computers to teach and research is weak due to lack of access to the Internet, electricity, lack of computers and technical know-how
Opoku, Badu and Alupo (2016)	Effort to Implement ICT Policy in Basic Schools in Ghana: An Assessment of Available Facilities and Resources for Successful ICT Education within the Atwima Nwabiagya District in Ashanti Region	Resources and materials available for teaching and learning ICT in Atwima Nwabiagya District in Ghana.	Mixed Method	Needed resources for teaching and learning ICT. Schools lack ICT labs, internet connection, and other resources needed to make teaching a success
Mark and Emmanuel (2019)	Challenges facing the implementation of ICT implementation at the primary schools	ICT resource availability, utilization and attitude of teachers and pupils to ICT implementation at primary schools	Quantitative study Descriptive survey design	Unavailability of ICT equipment and the lack of access to ICT infrastructure.
Peprah (2016)	ICT education in Ghana: an evaluation of challenges associated with the teaching and learning of ICT in basic schools in the Atwima Nwabiagya district in Ashanti region	Challenges associated with the implementation of ICT policy in the Nwabiagya District in Ashanti region	Qualitative Case Study	Lack of computers, unqualified teachers, limited practical after teaching, lack of internet access.

In the context of Ghana, Opoku et al. (2016) conducted a critical assessment of the availability of facilities and resources necessary for successful ICT education within the Atwima Nwabiagya district of Ghana. Similarly, Mark and Emmanuel (2019) examined the challenges faced in implementing ICT in primary schools. Karakara and Osabuohien (2019) also investigate households' access to ICT and the

resulting educational vulnerabilities of children. Buabeng-Andoh (2019) explored the factors that influence the pedagogical use of ICT by secondary school teachers. In a previous study, Buabeng-Andoh (2012) explored the skills, perceptions, and practices of ICT among teachers in Ghanaian second-cycle schools. Natia and Al-Hassan (2015), in an inter-district study, explored the extent to which ICT promotes school administration, teaching, and learning in Ghanaian basic schools.

Furthermore, Adu-Gyamfi (2017) discusses the attitudes of pre-service teachers towards the use of ICT in education in a study conducted in selected colleges of education in Ghana. Yaw and Acquah (2012) assess the status of implementation of ICT curriculum in Ghanaian basic schools. The study was aimed at finding out the extent of the effective implementation of the ICT curriculum in basic schools. Ankrah and Abah (2020) assessed the usage and impact of ICT centres for digital inclusion in Ghana. Related to the implementation of the ICT curriculum in Ghana's basic schools, Sarfo et al. (2017) investigated the concerns and found that teacher concerns were not related to teacher experience.

Barriers to ICT integration in education

Using a case study approach, Ergado et al. (2021) examined the obstacles that hinder the adoption of ICT in Ethiopian higher education institutions, employing Tornatzky and Fleischer's (1990) Technology-Organisation-Environment framework. The study employed qualitative research methods, including semi-structured interviews and focus group discussions, to gather data from stakeholders within the higher education institutions. The study findings reveal critical technological, organisational, and environmental barriers significant for future strategic plans to effectively implement ICT effectively in the teaching and learning practises of higher learning institutions in Ethiopia.

Samarakoon et al. (2017) studied challenges of technology use in Sierra Leone's education, highlighting issues like insufficient electricity, limited ICT-proficient teachers, and obstacles to ICT integration. Yaw and Acquah (2012) explored the successful ICT curriculum implementation in Ghana's primary schools, noting positive teacher perception but inadequate ICT resources. Ankrah and Abah (2020) evaluated ICT centers in Ghana, revealing challenges such as poor policy, network connectivity, computer availability, power outages, virus threats, and low computer skills. In related research, Castillo (2017) explores the factors and obstacles that contribute to both the success and failure of ICT integration in basic public schools in the Philippines. The study identifies human factors, such as leadership and teacher motivation, as significant barriers to the effective implementation of ICT integration in schools. To advance research on ICT for development (ICT4D) in India, Potnis et al. (2017) discuss how barriers to engaging with marginalised communities can be addressed. Salam et al. (2018) explore the impediments to integrating ICT in public schools of contemporary societies in Pakistan. In the Sri Lankan context, Vidanagama and Karunathilake (2021) explore barriers to the use of ICT in secondary schools and identify infrastructure, teacher perception, ICT competencies as factors affecting ICT use in schools.

Theoretical perspectives and methodological approaches adopted in the studies

Out of the total publications, a small portion of them (5.63%) explicitly state the specific theoretical perspectives that were used to guide their study. Most of the papers (94.37%), however, do not clearly indicate the theoretical or conceptual framework that informed their analysis. It was evident that the theory of Technology-Organisation-Environment (TOE), Technology Acceptance Model (TAM), UTAUT, ICT Adoption for Education Framework, and Activity Systems Analysis Approach were the theoretical perspectives explicitly specified in literature.

The study by Ergado, Desta and Mehta (2021) that explored the barriers determining ICT implementation in Ethiopian higher education institutions uses the technology-organization-environment (TOE) framework to analyze the results of the study. The TOE framework is an organisation-level theory

that explains that the elements of technological context, organisational context and the environmental context of a firm influence technological adoption and innovation (Baker, 2012). Nurjanah, Santoso, and Hasibuan (2018) use the ICT adoption for education framework to test user acceptance of ICT adoption in a quantitative study. Using a blended learning approach, Yeop et al. (2019) used the Unified Theory of Acceptance and Use of Technology (UTAUT) theory to analyse the implementation of ICT policies to investigate the factors of behaviour intention (BI) and use behaviour (UB) through experience and workload of teachers. Razak et al. (2018) use the activity systems analysis (ASA) approach to explain the conditions and systematic contradictions that facilitate successful ICT integration in Malaysian schools. Gyamfi (2017) used Technology Acceptance Model (TAM) to analyze the acceptance of ICT in education by pre-service teachers in selected colleges of education in Ghana.

Using the policy goal means analysis framework (PGMA), Aziz (2020) analysed the digital inclusion policy of Bangladesh in a qualitative study. The researcher discovered that the national ICT policy lacks clarity and is primarily focused on technology, with a narrow perspective on digitization that fails to adequately address the various aspects of digital inclusion in the country. Figure 2 presents a summary of the methodologies used in the studies.

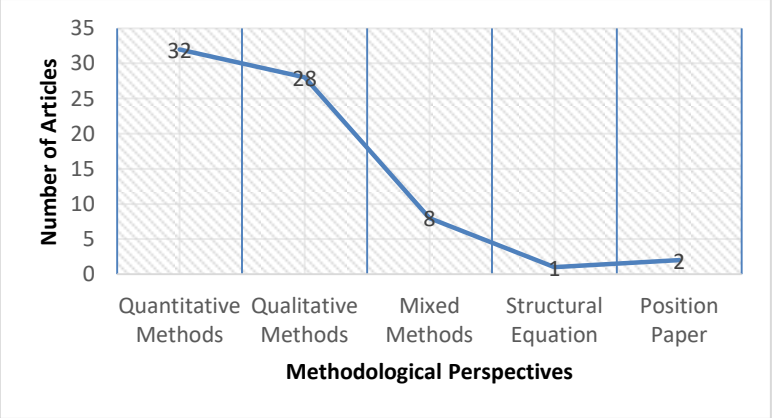

Figure 2. Methodological approaches adopted in the studies.

Thirty-two (45.07%) of the articles analysed applied quantitative methods to collect and analyse data on the study of ICT integration in classrooms. The articles mainly applied surveys and used questionnaires to acquire data from respondents for the study. Finding the choice of positivist research design approaches to be dominating other research designs used to investigate social science phenomena in the review is intriguing to the researchers. These articles applied statistical tools to analyse and present their findings which might not fully capture the depth and richness of the subjects. For secondary quantitative data, two articles (2.82%) selected for the review based their study on data drawn by national institutions such as the Ghana Demographic Health Survey (GDHS) (see, e.g. Karakara and Osabuohien, 2019; van de Werfhorst, Kessenich, and Geven, 2020). It was also observed that twenty-eight articles (39.44%) use qualitative methods such as interviews, document analysis (Aziz, 2020; Lim et al., 2020; Stoilescu, 2017), panel discussions (Potnis et al., 2017) and observations (Engelbrecht et al., 2015) for their study. Some articles identified the use of qualitative designs as case studies (Byker, 2014; Engelbrecht et al., 2015; Mena et al., 2019; Rana, 2018), interpretive phenomenological analysis (Peprah, 2016; K. Rana et al., 2020) and ethnography (Sarkar, 2018; Soriano et al., 2018a). Mixed methods consisted of situations where there is a combination of surveys and interviews (Castillo, 2017), questionnaire and focal group discussions (Ergado et al., 2021; Vanderlinde et al., 2012) surveys and semi-structured interviews (Ndibalema, 2014). Finally, two (2.82%) of the analyzed articles were specifically identified as

position papers (Livingstone, 2012; Sampath Kumar & Shiva Kumara, 2018) and one article use the structural equation model (Santos et al., 2019).

Contradictions in the Literature

The literature on ICT integration in education reveals contradictions related to accessibility, policy implementation, teacher adoption, socio-economic impact, and public ICT use. These inconsistencies underscore that the effectiveness of ICT varies based on context, infrastructure, and socio-cultural influences. Conflicting findings exist regarding ICT access and its impact on education. Karakara and Osabuohien (2019) assert that ICT access enhances learning, while Sampath Kumar and Shiva Kumara (2018) found that urban students in India benefit more than their rural counterparts. In contrast, studies in Ghana (Natia & Al-Hassan, 2015; Opoku et al., 2016) report ongoing shortages and infrastructural gaps. Svensson (2017) observed that in Nairobi slums, ICT is mainly used for lesson planning rather than direct teaching. These findings call into question whether mere access to ICT guarantees educational improvements.

Despite the existence of ICT policies, their effectiveness is inconsistent. Some studies identify barriers such as inadequate infrastructure, limited teacher training, and poor implementation (Peprah, 2016; Opoku et al., 2016). Conversely, research by Sarfo et al. (2017) suggests that teachers' concerns about ICT curriculum implementation are unrelated to their experience, indicating that policy impact varies by context. Ankrah and Abah (2020) highlight weak ICT policies as impediments to digital inclusion, reinforcing doubts about government initiatives. These contradictions imply that the effectiveness of policies is contingent on local implementation and infrastructure.

Research presents divergent views on teachers' attitudes toward ICT. While some studies indicate a positive outlook (Adu Gyamfi, 2017; Yaw & Acquah, 2012), Buabeng-Andoh (2019) found that teachers primarily employ ICT for basic tasks, such as presentations, rather than for transformative teaching. Svensson (2017) noted that in Nairobi slums, ICT functions more for administrative purposes than instructional ones. This raises questions about whether systemic barriers, rather than teacher willingness, impede ICT integration. The relationship between ICT access and socio-economic factors remains ambiguous. Karakara and Osabuohien (2019) contend that household wealth affects ICT access, yet Quattri and Watkins (2019) found that economic pressures, such as child labor, prevent ICT use even when it is available. Similarly, Joshi et al. (2020) identified a gender gap in ICT use in Indian slums, challenging the assumption that ICT access alone promotes educational inclusion.

The use of ICT in shared public spaces presents both advantages and challenges. Byker (2014) discovered that community computing initiatives in Indian slums empowered marginalized groups, whereas Soriano et al. (2018) raised privacy concerns in Philippine slums, suggesting that shared ICT access may also create social barriers. These contradictions in ICT research indicate that integration is complex and influenced by local factors. While some studies emphasize the transformative potential of ICT, others reveal infrastructural, socio-economic, and pedagogical challenges. Future research should aim to bridge these gaps by exploring how policy, access, and cultural factors interact to affect ICT adoption in education.

CONCLUSION

The use of ICT4E has gained significant attention as a potential tool to improve teaching and learning outcomes in basic schools. This systematic literature review aimed to synthesize the existing evidence on the impact of ICT4E interventions in slum schools, with a focus on the role of context and utilization in determining the effectiveness of these interventions for learners in marginalized communities. The literature revealed the general focus of these investigations on the availability of ICT resources in schools,

pedagogical uses of ICT, and teacher perceptions regarding ICT use in the classroom. Our review identified a small but growing body of literature on ICT4E in slum schools. Studies included in this review suggest that ICT4E interventions can have a positive impact on teaching and learning outcomes, including academic achievement, motivation, and participation. However, the quality of the evidence base is mixed, with some studies demonstrating strong methodological rigour, while others are limited by small sample sizes. It was noted that while technology integration in schools has been extensively studied, technology utilisation in slum public basic schools have not been explicitly focused in the literature considering their unique infrastructure and socioeconomic conditions.

The focus has primarily been on the lack or insufficient ICT resources (see Ackah & Addy, 2018; Blamah et al., 2020; Mark & Emmanuel, 2019) and infrastructure in schools (Alsabawy et al., 2013; Brown & Thompson, 2011; Pima & Sedoyeka, 2016; Sey, 2013), but the impact of this "lack of access" on teachers' integration practices and the strategies they employ to overcome challenges remains unexplored. Furthermore, there is a lack of research on how the absence of ICT resources influences teachers' beliefs about ICT and their actual utilization of ICT in schools. This knowledge gap highlights the need for further research to examine the extent of ICT integration in Ghanaian slum public basic schools. While some authors argue that the challenges of ICT integration are minimal in urban schools than rural schools (see Ampofo & Abigail, 2020; Opoku et al., 2016; Pima & Sedoyeka, 2016), how these challenges are overcome, mitigated, or eliminated by teachers and pupils appear non-existent in literature. Besides, as slums continue to be a relatively under-studied terrain, the emerging literature on marginalised societies is substantial and noticeable as an emerging phenomenon in the global literature.

Methodological and theoretical analysis revealed that the scientific community that produces ICT4E research focusing on slum communities appears to be non-existent. Context is an integral component of educational research (Kivunja et al., 2017; Rosenberg & Koehler, 2015), but has received less attention in educational technology research (Mishra, 2019). This review highlights the importance of context, which encompasses the socio-cultural, economic, and educational environment of the school, students, and teachers, and its impact on teaching and learning. While context is acknowledged as significant in fields related to educational technology(Mishra, 2019; Rosenberg & Koehler, 2015), it has often been overlooked in previous research (Hasala & Kelly, 2020). However, notable exceptions like Technological Pedagogical Content Knowledge (TPACK) emphasize the significance of context (Ling Koh et al., 2014; Rosenberg & Koehler, 2015). Recognizing context is crucial for effective ICT integration in education, as teachers need to comprehend the interplay between technology, pedagogy, content knowledge, and the learners' background.

The findings of this systematic literature review have implications for theories related to educational equity, the digital divide, and technology adoption. It highlights how ICT integration in underprivileged areas aligns with broader frameworks and reveals gaps in existing theories regarding ICT use in low-resource environments, thereby opening avenues for refining these theories to include socio-economic factors and infrastructure limitations. The review identifies gaps in the ICT integration research field, pointing to potential directions for future research.

Future research on ICT integration in education should focus on context-specific strategies that address socio-economic challenges and promote inclusive policies for schools in slum areas. Additionally, exploring innovative research methodologies and integrating technology-driven initiatives with broader urban development programs can improve learning outcomes and help bridge the digital divide.

The role of context and utilization in determining the effectiveness of these interventions, as well as the use of the TPACK framework to understand the factors that influence utilization, warrants further investigation. Understanding how teachers and students negotiate these technological challenges would

provide insight to education sector stakeholders on innovative strategies to ICT integration, particularly after the outbreak of COVID-19 which caused renewed reliance on technology and its role for teaching and learning.

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