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Education and Technology in Ghana: Understanding the Centrality of Technology Integration in the Classroom and Beyond

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Abstract The study aimed to conduct a systematic review of literature on the nature of technology integration in education. The researchers found five major areas in the literature that appeared to give policymakers guidance on how to incorporate technology into the teaching and learning process. These areas were understanding and using new technologies, funding of technologies in education, teacher preparedness in ICT integration, safeguarding ICT and perceived use in school as well as the impact of stakeholders in ICT integration. The study used the narrative review and documentary analysis approach in order to determine the essential factors of a successful technology integration strategy; it examined the difficulties educators and learners have while utilizing ICT in the classroom; and offers recommendations on how to use technology to enhance learning outcomes. The study considered the Technology Acceptance Model (TAM) by Davis [5] and the Diffusion of Innovations by Rogers [6] as the theoretical framework. The study recommends that Ghanaian educational institutions must embrace and successfully integrate technology in the classroom and in larger educational contexts, given the growing reliance of society on digital tools resources. Again, infrastructure in technology such as computers and tablets, consistent internet connectivity, and backup power sources in places with erratic electricity, need to be given a priority by the government and educational stakeholders. Other priority actions required are prioritising community technology centres, giving low-income students access to subsidised internet connection, and supplying subsidised gadgets.

Keywords: *Technology in education, technology integration, new technologies, digital world, digital literacy*

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1. Introduction

The overview of technological infrastructure and use of Information and Communication Technology (ICT) in education is intended to provide decision-makers with useful insights into the major issues and challenges of introducing technology in education. Providing foundational education in Ghana and many parts of the sub-Saharan African for some time now continue to be without bottlenecks [1]. The conception of what should be a developmentally appropriate teaching and learning experiences has seen reviews over the years. As a result of the wrong conceptualisation of how an ideal learner should be over the years, there have been different shades of interventions with regards to teaching and learning from the kindergarten to the higher level of education. One of the areas that has been negatively impacted is literacy in ICT. In spite of the commitment that learners have, there seem to be challenges in the learning of 21st century skills in the area of ICT. Touray, Salminen and Mursu [2], in a systematic literature review of ICT4D journals, identified over 40 challenges associated with the implementation of ICT use in schools.

In recent years, the integration of technology in education has become a focal point of educational reform and innovation. The proliferation of digital tools, online resources, and interactive platforms promises to revolutionise the learning experience, offering unprecedented opportunities for personalised instruction, collaboration, and access to information. However, as educators, policymakers, and researchers enthusiastically embrace these advancements, a critical question emerges. The early enthusiasm for integrating technology frequently obscures the difficulties and complications that come with this digital revolution. Although the use of technology can improve student achievements, it can also reinforce existing disparities, divert attention from instructional objectives, and give rise to new kinds of digital divides. Moreover, the rapid adoption of new technology trends may sometimes lead to superficial changes instead of significant, empirically validated improvements in teaching and learning.

This research aims to rethink technology integration in education by examining its impact on various aspects of the educational ecosystem. It explores the effectiveness of digital tools in improving student engagement and achievement, the role of teachers in navigating and leveraging technology, and the broader societal implications of a tech-centric approach to education. By critically analysing current practices and proposing thoughtful, informed strategies, this study seeks to ensure that the integration of technology truly serves the educational needs of all students and prepares them for a rapidly evolving digital world. In essence, this research calls for a balanced and reflective approach to technology in education, one that prioritises pedagogical integrity, equity, and sustainability. It invites stakeholders to pause and consider whether we are indeed on the right path, and if not, how we might chart a course that better aligns with our educational values and goals. Similarly, in the 21st century, technology has become a third language that cuts across continents around the world [3]. For this reason, those who are not able to communicate effectively with this new language will find it difficult to actively engage in the global discourse. One area that seems to be deficient for Ghana as a sub-Saharan African country is the provision of adequate technological resources in our educational system. It is evident that the education ministries of these countries are leaving no stone unturned to provide cutting-edge technological resources at all levels of education.

In spite of the effort to provide these ICT tools in schools, a closer look at the basic level of education in many African countries seems to be the only level where pupils are not exposed to any form of external placement examination as compared to the other levels of education. Due to the absence of examination anxiety, the learners have the freedom to explore more, identify their talents, and build upon them. This makes it good ground to provide these technological resources at the early stages of their lives for them to interact with them. However, there are many primary schools across Ghana that do not have the requisite technology tools for the learners to interact with the teaching and learning process [4].

At the secondary level of education in Ghana, the majority of senior high schools have state-of-the art technology resources. These technological resources are usually provided by the government of Ghana, alumni, non-governmental organisations, philanthropists, etc. However, in spite of the availability of these technology tools, there are students who are not motivated to visit the ICT laboratory on a regular basis since the learning of the ICT course is not examinable on one hand, and the fact that the teachers do not educate the learners for them to know the need to be abreast with the 21st century modern tools. Thus, when teachers fail to incorporate these technology tools into the teaching and learning process, students imperceptibly develop the view that technology use is less important to their lives in general. Therefore, despite the abundance of computers at various computer labs, students show the least interest in visiting the ICT labs.

Furthermore, at senior high schools across the country, students do not have the opportunity to use smartphones for both personal and educational reasons. The Ghana Education Service, which is in charge of creating and carrying out educational policies in Ghana, has a regulation that prohibits senior high school students from using phones in class. Although there may be some benefits to prohibiting senior high school students from using phones, overall, the students lose out on the opportunities provided by mobile learning, which might have been integrated into the senior high school curriculum. All these factors work against the smooth integration of technology tools in Ghanaian schools.

Additionally, a student's decision to pursue higher education in the future is made at the senior high school level. Obtaining a passing grade is a prerequisite for enrolment in any higher education institution. For this reason, the administration of the school, teachers, parents and the students themselves wish to establish a prerequisite that would support higher grades upon completion of the senior high school curriculum. This underscores the need to systematically review this literature with the hope that stakeholders in education will see the need to integrate ICT use in school for the achievement of these aspirations of students.

2. Statement of the Problem

The use of technology in education has become essential to forming the contemporary learning environment in the quickly changing digital world. Even with our increasing understanding of the digital age and its resources, there is still a great deal of variance in the ways that technology is incorporated into teaching methods, particularly in poor nations. The endeavour made by educators and other stakeholders in the field of education to use technology to improve student engagement and accomplishment cannot be undervalued because of the concerns this discrepancy raises about how best to use it. The focus of technology in education goes beyond simply having digital gadgets available; it also includes how to use them to promote critical thinking, deeper learning, and teamwork. However, obstacles including inadequate teacher preparation, student access to technology, and the possibility of digital distractions make it more difficult to successfully integrate technology into education in Ghana and elsewhere. There is undoubtedly a plethora of obstacles that prevent teachers and students from effectively using ICT for teaching and learning. Therefore, the purpose of the study is to find out the variables that affect the efficient use of technology in the classroom, pinpoint the obstacles that teachers and students in particular encounter when integrating ICT into the classroom, and investigate methods for optimising the advantages of technology in boosting learning opportunities both within and outside of the classroom.

3. Purpose of the Study

i. To determine the essential factors of a successful technology integration strategy.
ii. To examine the difficulties educators and learners have while utilizing ICT in the classroom.
iii. To offer recommendations on how to use technology to enhance learning outcome.

The Theoretical Framework

The theoretical framework for this research was derived from two theories: the technology acceptance model (TAM) by Davis [6] and the Diffusion of Innovations by Rogers [7]. According to Marangunić, and Granić [7], the adoption of an innovation spreads through certain channels and across time among the people who make up a social system. The two theories being used as a framework fall within the observation of these researchers. TAM was propounded by Davis during his doctoral degree. Davis originally posited that there were two factors that contributed to the acceptance of a new computer system by the intended users. These were the perceived usefulness of the computer system as well as the ease of use of the system. The perceived usefulness explains the extent to which the user finds value in using the product and the perceived ease of use refers to the ability to use the product without too much difficulty on the part of the user. In other words, perceived ease of use is the technology being user-friendly; whereas perceived usefulness is the extent to which an individual feels that using a certain technology would improve work performance. Over the years, there have been slight modifications to the original two components of the technology acceptance model. The theoretical framework used for this review has perceived usefulness, perceived ease of use, knowledge on the technology use, and how the intention to use leads to the actual use of the computer system. These are the components that make up the TAM hypothesis, which represents TAM. This theory seems to explain the factors that users would consider when accepting a particular technology. However, what is clear with the technology acceptance model is the time taken for users to start using the product. Figure 1 illustrates TAM.

The second conceptual framework used by the researchers as a lens to look at the nature of technology integration in education was the DOI theory by Rogers [6]. Rogers explained the term diffusion as: "the process in which an innovation is communicated through certain channels, over time, among the members of a social system" (p. 5). From the definition, four main elements could be identified, innovation, communication channels, time and social system. To García-Avilés [8], diffusion is regarded as a special type of communication in which participants create and share information with one another in order to reach a mutual understanding [8]. Based on the two definitions, diffusion seeks to explain the stages and interactions involved in the decision-making process of any new product or idea. Rogers proposed five areas that impact on or speed up the adoption process as, relative advantage, compatibility with organizational knowledge, complexity to implement, trialability, and observability of the development of the innovation [8,9]. Rogers was emphatic that people who start the adoption process and fail to complete it as well as those who do not start the process at all do not form part of the diffusion process. In explaining the range of adoption within the diffusion process, Rogers indicated that there are five different categories of adopters who, based on their position, connection and linkages with the rest of the social system, take different time spans to adopt a new innovation. These are innovators (2.5%); early adopters (13.5%); early majority (34%); early minority (34%); and laggards (16%).

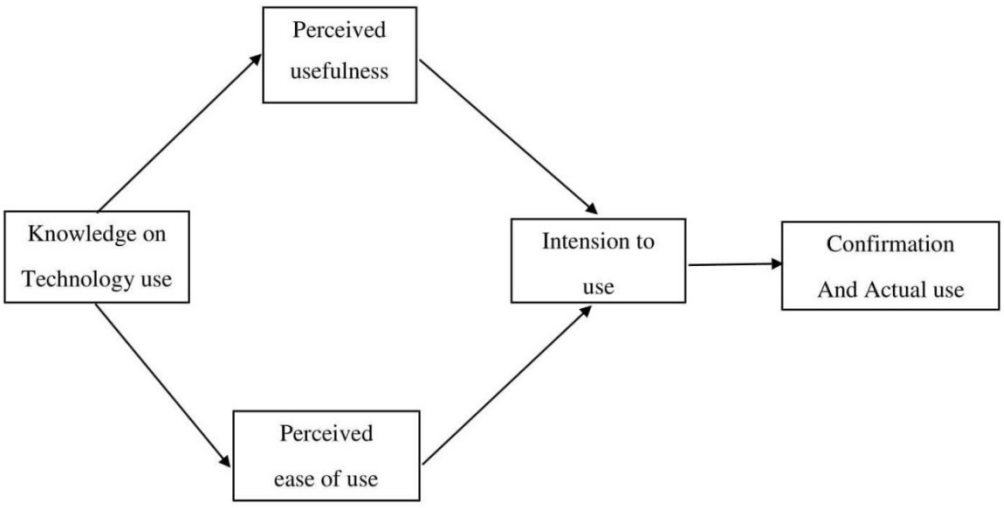

Figure 1. Technology Acceptance Model [5]

According to Rogers [6], the topmost level of the innovation-decision process is the innovators. These are members of the social system who have links with the outside world and are willing to take risks to bring in the new technologies. Their attitudes usually create many uncertainties for the other members of the social system and for that matter, they might not be accepted by the social system. The second group on the normal curve is the early adopters according to Rogers [6]. Unlike the innovators, the early adopters are confined within the social system and they normally occupy the leadership positions of the social system. As a result of their positions, they have strong links with the innovators and that is the reason why they are the first sub-group from the social system to adopt the innovation. In many cases, the other members of the social system look up to them for decisions. Light [10] indicated that the attitude of leaders towards a new technology is instrumental to the other members of the social system. The next sub-group of adopters is the early majority. They occupy one standard deviation from the mean on the left-side of the innovation-diffusion decision curve. According to Rogers, the early

majority members do not hold leadership positions and work their ways through interpersonal relations. Their decisions on adopting the innovation are slower than the early adopters but take time to think through their decisions. The late majority members also occupy one standard deviation from the mean on the right-side of the innovation-diffusion curve. This sub-group is usually alarmed with the uncertainties and would want to wait until the majority of the members of the social system has adopted the innovation before they get on board. In many cases, they are people who demonstrate poverty and deficiencies in mobilizing the required resources needed to adopt an innovation and are persuaded by close friends and peers in order to adopt the innovation. The last sub-group on the curve is the laggards. The members have similar features to the late majority. However, they are more traditional and would wait until an innovation is successful before they would adopt it. One of the reasons why they occupy the last position on the innovation-diffusion curve is the fact that their social network is made up of likeminded persons who are conservative and would not like to change easily. Broadly speaking, Rogers further grouped the adopters into early adopters (innovators, early adopters, and early majority) and late adopters (late majority and laggards). Figure 2 visualizes the innovation-diffusion decision curve by Rogers [6].

The theoretical underpinnings, which describe how knowledge and perceptions impact the perceived usefulness and the ease of use of ICT technologies as well as the rate at which adoption takes place within the innovation-diffusion social system, have practical implications on the use of technologies in the education system. There are a number of elements from the two theories that are directly or indirectly related to the main purpose of this study. For this reason, the theories have been woven together to provide a comprehensive review of the subject being studied.

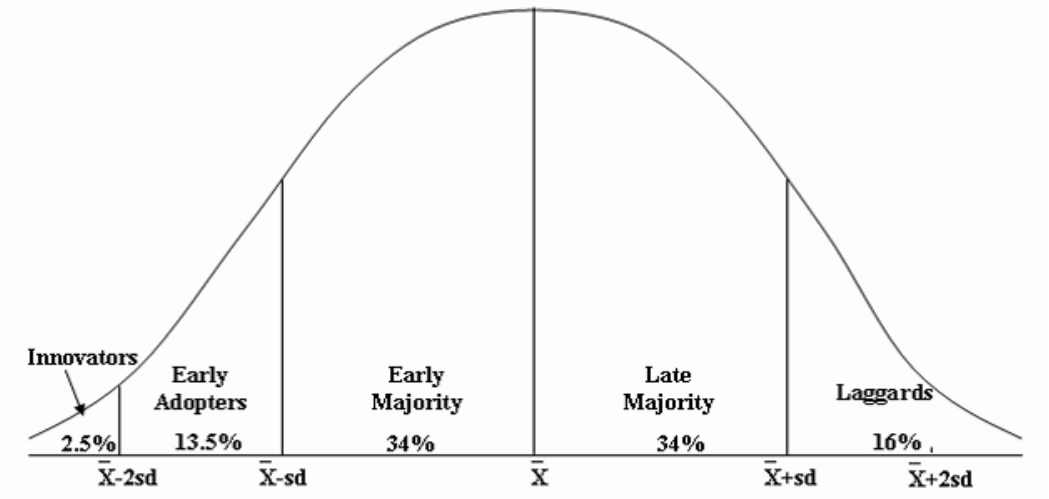

Figure 2. Adopter Categorization on the Basis of Innovativeness [6]

4. Methodology

In this study, both the narrative review and documentary analysis were employed. The narrative review provides a thorough grasp of what has been written in the field by synthesising the available and current literature on the subject. The identification of major themes is made possible by this methodological technique, which takes trends and gaps in the study topic into account [11]. This method works well for summarising and critically assessing the information found in a variety of relevant books, journals, and papers [12]. It aids in grasping how the area has developed, the many viewpoints that have emerged, the consensus or disagreements among academics and overall provides context for the research. The researchers used documentary analysis to gather pertinent data and insights on the research such as policy papers, educational directives, and scholarly articles.

Understanding and using new technologies

The choice of ICT should equally take into account the widely used older technologies such as print, radio, and television. It is becoming increasingly evident that leapfrogging technologies, wherever possible, remain the primary alternative for a quicker response to the daunting challenge of access and equity. In order to make improved choices about the educational use of technologies, it is necessary to develop an understanding of the modes of communication appropriate to teaching and learning. This overview emphasises the importance of being aware of the range of educational technologies available and provides structured analysis of the technologies in schools and their applications as a basis for reviewing the context in which technology is used for educational purposes in Ghana. The rapid evolution of technology presents both opportunities and challenges for educational systems worldwide, particularly in Africa. Understanding and effectively using new technologies is crucial for fostering socio-economic development and enhancing educational outcomes. Access to technology remains a significant barrier in many African countries. Kenny and Hill [13] highlight that those disparities in internet connectivity, particularly between urban and rural areas, create a pronounced digital divide. In Ghana, efforts have been made to expand internet infrastructure, but challenges persist in reaching remote communities. Governments across Africa are actively

implementing policies to improve access. Agyemang and Hinson [14] also discuss Ghana's National Broadband Policy, aimed at increasing internet penetration and enhancing digital infrastructure. Such initiatives are crucial for bridging the digital gap and promoting technology use in education and other sectors.

The integration of technology in education is a focal point in many African nations. As a result, Boadi, Sarpong, and Mensah [15] emphasise that educational institutions in Ghana are increasingly adopting digital tools to enhance teaching and learning. Initiatives like the "One Laptop One Teacher" programme illustrate the commitment to integrating technology in classrooms. Effective implementation of technology hinges on adequate training for educators. Mensah and Manteaw [16] found that teacher professional development programmes in Ghana often lack comprehensive training on using new technologies effectively. Investing in continuous professional development is vital for empowering teachers to utilise technological tools effectively.

Studies reveal that utilising technology can greatly improve educational results. According to Osei and Osei [17], educational institutions that integrate ICT resources into their curricula frequently witness increases in student engagement and academic achievement. Technology enables customised learning experiences that meet the demands of a wide range of students. Technology affects economic development in addition to education. Hence, Abor and Quartey [18] reiterate that adopting technology encourages innovation and entrepreneurship, both of which are essential for creating jobs in Ghana. Many people are now able to participate in e-commerce and other digital companies because of the widespread use of mobile technology.

Significant obstacles still exist in the infrastructure required for the application of technology, notwithstanding advancements. Nti and Asare [19] observe that insufficient power supply and unstable internet connectivity frequently impede the efficient utilisation of technology in Ghanaian educational establishments. The adoption of technology can be influenced by societal attitudes and cultural views of it. According to Adomako and Fafunwa [20], scepticism and conventional wisdom might make it difficult for new technologies to be incorporated into daily life and education. Adoption of technology is often hampered by financial limitations. Kwarteng [21] postulate that a significant number of students and educators are unable to access the internet due to the high cost of devices and services which exacerbates the digital divide.

In Africa, mobile technology is revolutionising the field of education. Onjewu, Godwin, Azizsafaei, and Appiah [22] draw attention to the expanding field of mobile learning, or m-learning, as a practical substitute for reaching students who live far away. The widespread use of smartphones has increased accessibility and flexibility in education. In order to encourage the use of technology, community involvement and collaborations with non-governmental organisations (NGOs) are essential. Ankomah and Osei [23] considered programmes run by non-governmental organisations (NGOs) that give schools resources and training to improve the incorporation of technology. Encouraging STEM (Science, Technology, Engineering and Mathematics) education is essential to preparing young learners for a future where technology will play a major role in education. MOE [24] thought it wise to provide more funding for STEM programmes since they encourage young people to be innovative and tech-savvy.

It takes a comprehensive effort to understand and use new technologies in education, especially in Ghana. It requires addressing issues of access, implementation, obstacles and implications. Even though there has been a lot of progress, more work has to be done to make sure that technology promotes economic and educational growth. In order to remove obstacles and encourage the efficient use of technology in the classrooms, it is imperative that the government, educational institutions and communities prioritise collaboration. Technology development is now one of the main factors propelling economic expansion and development in Africa, especially in Ghana. This review of the literature looks at the approaches governments in Ghana and throughout Africa have made in terms of technology policy, with a particular emphasis on strategic frameworks, implementation difficulties and results. The national technology policy roadmap is often established by the policies of succeeding governments. In Ghana party manifestos are where choices about the use of technology in the classroom are made. In their manifestos, political parties typically lay out their goals, which ultimately become the daily policies that the Ministry of Education carries out. Regrettably, this approach to technology utilisation is prevalent in many African countries [25]. Technology policies are implemented by the current political party in accordance with the specifications outlined in its manifesto.

Experts in the field of educational technology convene with stakeholders in other locations to gather their perspectives on the ideal usage of technology [26]. Following these stakeholder conversations, an in-depth technological report was created to act as a future reference material. There may be a long-term, medium-term, or short-term plan for the country's use of technology, depending on the committee assigned to carry out that crucial responsibility. Following adoption, the text becomes the national policy for the use of technology. These records may be examined on a regular basis in light of national requirements and necessities. Everyone must share responsibility for ensuring that whatever is agreed upon and accepted works for everyone's benefit.

Ghana has created a number of important technological policies to promote an atmosphere that is favourable for the expansion of ICT. The goal of the National ICT for Education Policy (2015) is to improve learning outcomes and digital literacy through the integration of ICT in educational systems [14]. The Ghana Digital Transformation Strategy (2020–2024) provides a thorough framework for utilising technology to advance economic development and enhance public services. This plan places a high priority on investments in digital infrastructure, encouraging technological innovation and accessibility in a range of industries including Ghana's Ministry of Communications [27]. There are still a lot of obstacles to overcome in order to fully execute policies. Inadequate money, a lack of infrastructure, and low

stakeholder participation are among the main obstacles to the successful implementation of technology policies in education [15]. The African Union's Agenda 2063 emphasises the role that technology will play in propelling Africa's socioeconomic change on a continental scale. In order to foster innovation and regional integration, this agenda supports the creation of strong ICT frameworks and policies [28]. The African Continental Free Trade Agreement (AfCFTA) underscores the function of technology in promoting trade and economic cooperation between African countries. In order to foster innovation and digital trade, the pact pushes member nations to establish a common technology policy [29].

Notwithstanding regional frameworks, obstacles can arise when national policies are aligned with continental goals. For example, Kenny and Hill [13] talk about how different African countries have different capacities for implementing policies, which causes differences in the continent's technological development. The creation of a digital economy is becoming a top priority for governments throughout Africa. According to Nti and Asare [19], policies that support fintech, digital entrepreneurship, and e-commerce are essential for boosting economic resilience and job development which ultimately affect education. The proliferation of digital services has made strong data protection regulations essential. Mensah and Manteaw [16] draw attention to Ghana's Data Protection Act (2012) as a crucial legal framework for guaranteeing privacy and protecting personal information online. Empirical studies demonstrate that efficacious technology policies have bolstered economic expansion in Ghana and other African nations. Improved service delivery and faster Gross Domestic Product (GDP) growth rates have resulted from increasing investment in ICT infrastructure, as demonstrated by Abor and Quartey [18]. Education-related technology policies have also had a big impact. According to Osei and Osei [17], efforts to incorporate ICT into schools have improved learning results and student involvement, demonstrating the efficacy of governmental programmes. In order for technological policies to be successful, inclusive stakeholder interaction is essential. In order to match programmes with real needs, Adomako and Fafunwa [20] support incorporating educators, industry players and local communities in the policy-making process. To support technological ambitions, it is imperative to invest in a strong infrastructure. Kwarteng [21] highlights that in order to improve the impact of technology policy and enable broader access to digital services, governments need to give infrastructure development first priority. To propel technological growth, regulations that foster entrepreneurship and innovation are crucial. Governments should establish funding programmes and incubators in this direction [24]. Ghana and Africa governments' technological policy orientations will have a significant impact on how the digital landscape develops in the future. Even though policy design and implementation have advanced significantly, there are still issues that must be resolved if technology is to completely fulfil its promise to promote economic development and growth. An emphasis on innovation, infrastructure investments, and stakeholder collaboration will be essential to pushing the technology agenda.

Funding of technologies in education

One of the most important factors still affecting the effective use of educational technologies is funding. The main source of funding for educational technology efforts in Ghana is the government. According to Agyemang and Hinson [14], the National ICT for Education Policy is one of the policies that the Ghanaian government uses to allocate a percentage of its budget to ICT in education. However, because of conflicting objectives, regular support is still difficult to achieve. Contributions from NGOs and the private sector are essential for boosting government support. Boadi et al. [15] highlight cooperative approaches to funding educational technologies by highlighting collaborations between schools and non-governmental organisations (NGOs) that offer technology resources and training. Ghana's educational technologies are largely funded by international groups and development agencies. Nti and Asare [19] point out how organisations like the World Bank and UNESCO offer financial support and technical help to encourage ICT integration in classrooms. A number of research suggests that investment in digital infrastructure is important. According to Osei and Osei [17], the development of dependable internet access and digital technologies to support learning is becoming a higher priority for both public and private organisations in Ghana. Financing initiatives have a strong emphasis on ensuring equity in access to technology.

Kwarteng [21] also notes that financing strategies are focusing more on underprivileged areas in order to guarantee that all pupils have access to digital resources and close the digital divide.A change is underway in the direction of creating long-term funding arrangements that encourage investment in educational technologies. Mensah and Manteaw [16] propose that in order to guarantee continuous support for technology integration in education, creative financial models like public-private partnerships (PPPs) should be encouraged. Budgetary restrictions are a significant financial concern in Ghana. Adomako and Fafunwa [20] claim that instructional technology frequently competes with other urgent requirements, resulting in an inadequate allocation of resources. The absence of continuous financial assistance for the upkeep and modernisation of technology infrastructure presents serious difficulties, even in cases where initial financing is available. Additionally, highlighting the necessity of sustainable finance strategies with maintenance plans are necessary [14]. Once more, ineffective bureaucracy makes it difficult to allocate and use cash effectively. Boadi et al. [15] believe that protracted procurement procedures may cause the rollout of educational technology projects to be delayed. Comparative research reveals effective funding models that Ghana could adopt from other nations.

According to Kenny and Hill [13], nations like Singapore and South Korea have successfully used a combination of public and private funding to support their educational technology efforts. Grants and technology vouchers are examples of creative financing strategies that have demonstrated potential for bolstering funding for educational technology. Initiatives that give schools vouchers to purchase technology are highlighted by MOE [24] as ways to encourage competitiveness and creativity.

Enhancing sustainability can be achieved by including stakeholders and local communities in funding efforts. Nti and Asare [19] underscore the significance of engaging parents and nearby enterprises in bolstering educational technology initiatives via financial contributions and resource exchange. Improving financing for educational technologies requires cultivating robust public-private partnerships. In order to maximise resources, Abor and Quartey [18] advise developing frameworks that encourage cooperation between the public and private sectors.

Comprehensive financing plans that take into account every stage of the technology integration lifecycle, from acquisition to upkeep, are required. Osei and Osei [17] are proponents of programmes that cover continuation assistance after the original investment. Promoting creative funding strategies like crowdsourcing and neighbourhood-based projects can open up new funding avenues for educational technology. Mensah and Manteaw [16] recommend looking into these options to improve the availability of resources. Investing in educational technologies is essential to improving classrooms in Ghana and elsewhere. Even if resource acquisition has come a long way, there are still problems that call for creative thinking and teamwork. Ghana may enhance its educational technology landscape by incorporating sustainable funding mechanisms and taking cues from successful models. The idea of allocating sufficient funds for technology use in the nation is linked to the absence of a defined policy direction by the government. When it comes to the adoption of technology, funding is critical.

In addition to the funding provided by the central government, many entities, such as individuals, institutions and associations also contribute to the acquisition of technologies for educational purposes [30]. However, when the total amount of money from all of these sources is added up, it still falls short of the amount required to supply these technological resources. The fact that the beneficiaries are unable to decide what kind of technological resources need to be supplied adds another dimension to this problem. Oftentimes, givers give what they have rather than what the receivers actually need. When this occurs, stakeholders or the general public have the idea that we have the necessary technologies. In the meantime, the current technologies are unsuitable for carrying out the necessary tasks in schools.

Teacher Preparedness and Literacy in ICT integration

In order to modernise teaching and learning procedures, ICT integration in education has become crucial. Teacher readiness is a major factor in the effectiveness of ICT integration in the classroom. Comprehensive training programmes are essential for giving teachers the knowledge and self-assurance they need to integrate technology into their lesson plans [14].

To improve teachers' ICT proficiency, several programmes have been started in Ghana. Government-led professional development initiatives to enhance teachers' digital competencies as a prerequisite for effective technology integration in the classroom are covered by Boadi et al. [15]. To stay current with developing technology, teachers and educators in general must engage in ongoing professional development. Nti and Asare [19] emphasise the value of continuous training sessions that concentrate on useful ICT applications in educational settings. ICT literacy is the capacity to utilise technology successfully, analyse information critically and use digital tools in educational settings among other abilities. ICT literacy is a critical skill that teachers need to have in order to support contemporary teaching methods [24]. Studies show that Ghanaian teachers have differing degrees of ICT literacy. According to Mensah and Manteaw [16], effective technology integration can be hampered by the fact that some teachers struggle with fundamental ICT abilities, while others exhibit high levels of digital competency. The availability of sufficient infrastructure and technology resources has a big impact on how prepared teachers are. Teachers have greater opportunity to grow professionally and incorporate technology into their lessons in schools with strong ICT infrastructure [17].

Promoting ICT integration requires institutional support from school leaders and the administration. Kwarteng [21] highlights that teachers might be inspired to use ICT and look for professional development opportunities by having clear policies and supporting leadership. Teachers' desire to use ICT can be influenced by cultural perspectives on technology. Adomako and Fafunwa [20] also indicate how teachers' opinions on the benefits of incorporating technology into the classroom may be influenced by conventional wisdom regarding education.

Many teachers still encounter difficulties in spite of efforts to prepare them because of insufficient training materials and support networks. Teachers' capacity to use ICT tools successfully may be hampered by a lack of opportunities for practical training [15]. One issue that frequently arises for teachers is resistance to implementing new technologies. Effective ICT integration in education is significantly hampered through obsolescence and a lack of trust in one's ability to use technology [13].

Funding constraints often limit the availability of necessary technological resources and training programmes. Nti and Asare [19] highlight that inadequate financial support can stall ICT initiatives within schools. Creating collaborative learning environments can enhance teacher ICT literacy. MOE [24] advocate for peer mentoring and collaborative professional development initiatives that allow teachers to learn from each other. Integrating ICT training into teacher education programmes is crucial for developing foundational skills. Abor and Quartey [18] also emphasise the importance of embedding ICT literacy in teacher training curricula to prepare future educators for the digital classroom. Employing innovative teaching methods that incorporate technology can enhance teacher preparedness. Osei and Osei [17] suggest that using blended learning and project-based approaches can increase teachers' engagement with ICT. Countries like Finland and Singapore have established effective models for teacher preparedness in ICT integration. Kenny and Hill [13] highlight Finland’s emphasis on continuous professional development and supportive policy frameworks as key factors in promoting teacher readiness. Several countries have developed comprehensive frameworks to guide ICT integration in education. Adomako and Fafunwa [20] also discuss how frameworks that outline clear standards and competencies for teachers can facilitate successful ICT adoption.

Teacher preparedness and literacy in ICT integration are critical for enhancing educational outcomes in Ghana. While challenges exist, targeted strategies and supportive frameworks can significantly improve teachers' capacity to integrate technology effectively. By learning from global best practices and fostering collaborative environments, educational systems can better prepare teachers for the demands of the digital age.

Safeguarding ICT and perceived use in school

The integration of ICT in educational settings has transformed teaching and learning processes. However, with the increased use of technology comes the necessity for effective safeguarding measures to protect students, teachers, and institutions from various risks. Studies highlight the growing concerns regarding cyber threats and online safety in schools. According to Hollis and Jamieson [31], the rise of cyberbullying and online harassment necessitates comprehensive digital safety programmes. Schools are urged to implement robust cybersecurity measures, including regular software updates, network security protocols, and user education programmes to mitigate risks. Baker, Smith, and Nguyen [32] emphasise the importance of training staff and students on recognising potential cyber threats, suggesting that awareness initiatives significantly reduce vulnerability to cyber incidents. Digital citizenship education is increasingly viewed as a critical component in fostering safe online behaviours among students. Effective safeguarding in ICT usage is heavily reliant on well-defined policy frameworks. It is as a result of this that Chen and Zhao [33] pointed out that various national and regional policies aimed at protecting students in digital environments are ongoing in institutions. Bediako and Kyei [34] indicate that many schools are implementing basic cybersecurity protocols, including firewalls and antivirus software, to protect school networks. Additionally, training programmes for teachers and students on recognising cyber threats are essential to building a culture of digital safety. Integrating digital literacy into the curriculum is vital for empowering students to navigate ICT responsibly. Mensah [35] notes that schools are increasingly adopting programmes that teach students about online safety, digital ethics, and responsible usage of technology. This proactive approach helps in mitigating the risks associated with ICT use.

Collaboration among stakeholders, including parents, local communities, and government agencies, is crucial for effective ICT safeguarding. In that direction, Ankomah and Osei [23] emphasise the role of community involvement in creating a safe ICT environment, advocating for awareness campaigns and collaborative initiatives to promote responsible technology use. With respect to architectural designs that promote flexible learning environments essential for effective ICT integration, MOE [24] argue that classrooms should be designed to accommodate various teaching styles, with movable furniture and adaptable spaces that facilitate group work and collaborative learning. Establishing dedicated ICT laboratories and resource centres is vital for fostering ICT education. Nti and Asare [19] highlight the importance of having well-equipped computer labs that provide students with hands-on experience and access to necessary technology resources. The design of educational buildings has a significant impact on the learning environment. Akosua, Mensah, and Kyei, [36] stress that incorporating natural light and proper ventilation in school buildings enhances students' comfort and concentration, thus supporting more effective ICT learning experiences.

Kwarteng [21] emphasises the importance of embedding technological infrastructure, such as electrical outlets, robust Wi-Fi connectivity, and network cabling, into school designs to facilitate seamless ICT usage. Designing safe and inclusive learning environments is critical for promoting equitable access to ICT. Owusu-Ansah [37] therefore notes that schools should consider accessibility features, ensuring that all students, including those with disabilities, can effectively engage with ICT resources. The safeguarding of ICT in Ghanaian schools requires a multifaceted approach, involving policy frameworks, cybersecurity measures, and community collaboration. Additionally, architectural designs play a crucial role in supporting ICT teaching and learning by creating flexible, well-equipped, and inclusive environments. As Ghana continues to advance its educational landscape, a strong emphasis on both safeguarding practices and innovative architectural solutions will be essential for fostering effective ICT integration in schools. These policies aimed to identify key components of successful policies, such as clear guidelines on acceptable use, data protection and incident reporting mechanisms. Furthermore, Sullivan et al. [38] advocate for the alignment of school policies with national cybersecurity strategies, stressing the importance of a coordinated approach to ensure comprehensive protection across educational institutions.

Morgan and Smith [39] outline practical measures, including the establishment of an ICT committee to oversee technology use, regular audits of ICT resources, and the integration of safety features in educational software. Additionally, Davis [40] emphasises the significance of collaborative approaches, where schools engage with parents and community stakeholders to create a holistic safeguarding environment. Involving parents in digital safety discussions can enhance support systems at home. Jackson [41] calls for adaptive safeguarding strategies that evolve alongside technological developments. Schools must stay informed about the latest trends and potential risks associated with new technologies to ensure that effective safeguarding measures are in place. The safeguarding of ICT use in schools is an evolving challenge that requires ongoing attention and collaboration among all educational stakeholders. The integration of ICT in Ghanaian schools has become essential for modernising education. However, this integration requires robust safeguarding measures and architectural designs that support effective teaching and learning. Adu and Owusu-Ansah [42] highlight the significance of national policies, such as the Ghana National ICT for Education Policy, which provides guidelines for safe and responsible ICT usage. These policies emphasise the need for schools to establish clear acceptable use policies to protect students and staff.

Impact of Stakeholder in ICT integration

The actual system use of ICT in education has been a

significant focus for educational reforms globally. Various stakeholders, including policymakers, teachers, students, parents, and technology providers, play crucial roles in the successful implementation and sustainability of ICT initiatives.

Policymakers are instrumental in setting the vision and framework for ICT integration in education. Their decisions on funding, curriculum development, and training programmes significantly influence the extent and effectiveness of ICT use in schools. Research indicates that national and regional policies are critical in providing a structured approach to ICT integration. Policies that support infrastructure development, teacher training, and curriculum updates are essential [43]. Again, policymakers control the allocation of financial resources, which directly impacts the availability of ICT tools and infrastructure. Studies highlight the disparity in ICT integration between well-funded and underfunded schools, which calls for equitable resource distribution [44]. Teachers are the primary agents of change in implementing ICT in classrooms. Their attitudes, skills and readiness to adopt new technologies are pivotal for successful integration. Continuous professional development is crucial for teachers to keep pace with technological advancements. Inadequate training can hinder effective ICT use [45]. Teachers' positive attitudes towards ICT and their belief in its benefits can enhance integration. Conversely, resistance to change and a lack of confidence in using technology can be significant barriers [46].

Effective ICT integration requires a shift from traditional teaching methods to more learner-centred approaches. Research shows that when teachers integrate ICT into their pedagogy, it can lead to improved student engagement and learning outcomes [47]. Students are the direct beneficiaries of ICT in education. Their engagement, adaptability, and feedback are critical for shaping ICT practices. ICT tools can enhance student engagement and motivation by providing interactive and personalised learning experiences [48]. Developing learners' digital literacy skills is essential for their future success. Research highlights the importance of integrating ICT into the curriculum to equip learners with the necessary digital skills [49]. Leaners feedback on ICT tools and applications can guide teachers and developers in refining and improving ICT integration [50]. Again, parents' support and involvement are crucial for reinforcing ICT use beyond the classroom. Access to ICT tools at home and parental encouragement can enhance students' ICT skills and learning experiences [51]. Parents' perceptions of the value of ICT in education can influence their support for its use in schools. Studies suggest that informed and positive parental attitudes can foster a supportive environment for ICT integration [52].

Technology providers play a significant role in developing and supplying the necessary tools and resources for ICT integration. Providers contribute by creating innovative educational technologies and offering technical support and training for teachers [53]. Effective partnerships between schools and technology providers can facilitate the smooth implementation and customisation of ICT tools to meet specific educational needs [54]. The interplay between these stakeholders often presents challenges that need to be addressed for successful ICT integration. Lack of coordination among stakeholders can lead to fragmented ICT initiatives. Collaborative efforts and clear communication are necessary for cohesive integration [55]. Ensuring the sustainability of ICT projects requires ongoing support from all stakeholders. Studies emphasise the need for continuous funding, professional development, and updates to technological infrastructure [56]. Addressing the digital divide is crucial for equitable ICT integration. Policymakers and educators must work together to provide equal access to technology for all students [57]. The successful integration of ICT in education is a complex process that involves multiple stakeholders. Policymakers, teachers, students, parents and technology providers each play vital roles in shaping the landscape of ICT in education. Understanding their impact and addressing the challenges they face can lead to more effective and sustainable ICT integration, ultimately enhancing educational outcomes.

5. Conclusions

The integration of technology in education is an evolving journey that holds immense promise and potential. As we assess our current trajectory, it is clear that significant strides have been made, yet critical reflections reveal areas needing improvement. Technology has undoubtedly transformed the educational landscape, enhancing access to information, enabling personalised learning, and fostering collaboration beyond traditional classroom boundaries. However, challenges persist. The digital divide remains a substantial barrier, with unequal access to technology exacerbating educational inequalities. Moreover, the overemphasis on technology can sometimes overshadow fundamental pedagogical principles, risking a decline in the quality of education if not carefully managed. The rapid pace of technological advancement also necessitates continuous professional development for educators to keep pace with new tools and methodologies. To ensure we are on the right path, a balanced approach is crucial. Integrating technology should not be an end in itself but a means to enrich and support the educational experience. Stakeholders must prioritise equitable access, ongoing teacher training, and the development of digital literacy skills among teachers and students. Evaluating the effectiveness of technology through rigorous research and feedback loops will be essential to making informed adjustments and innovations. Ultimately, rethinking technology integration in education requires a collaborative effort among educators, policymakers, students, and communities. By addressing the challenges and leveraging the opportunities, we can create an educational environment that not only embraces technological advancements but also upholds the core values of teaching and learning. This reflective and adaptive approach will ensure that technology serves as a powerful ally in the quest for educational excellence and equity in Ghana and beyond.

Recommendation

To improve teaching and learning outcomes in Ghana, technology integration into the classroom is crucial. Ghanaian educational institutions must embrace and successfully integrate technology in the classroom and in larger educational contexts, given the growing reliance of society on digital tools and resources. Therefore, substantial technological infrastructure should be invested in by the government and educational stakeholders. This includes access to contemporary technologies, such as computers and tablets, consistent internet connectivity, and backup power sources in places with erratic electricity. A key component of a successful integration is making sure all schools, especially those in rural areas, have the required technology infrastructure. Second, a need exists for a comprehensive and periodic national ICT professional development programme to equip all teachers with the requisite knowledge and practical skills to meaningfully integrate 21st century technologies into the teaching and learning. To further boost the interest and confidence level of these teachers in the use of ICT, part of the periodic ICT training should be available online for them to be familiar with the virtual environment as they play with the numerous resources. Third, measures should be in place to educate the learners on the benefits of being immersed in the use of ICT tools. In addition to providing the requisite digital tools and software applications to interact with, aspects of learners' assessment should be by the use of ICT tools. This approach of using ICT tools during examinations will create a new direction of thinking, where learners will see knowledge and skills in ICT as a tool of communication as well as a key to overcome learning challenges. Finally, all subject areas in Ghana's school curriculum ought to be updated to include technology. As part of this, digital literacy will be incorporated into the curriculum at all educational levels, from primary school to postsecondary. Curriculum designers should make sure that technology fosters creativity, critical thinking, and problem-solving abilities by being an essential component of the educational process rather than only an optional addition. It is imperative to prioritise digital equity in order to stop the digital divide from growing. This entails making certain that every student, irrespective of their financial status, has access to the tools and technologies they require. Priority should be given to projects like establishing community technology centres, giving low-income students access to subsidised internet connection, and supplying inexpensive gadgets.

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