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Original Paper

Digitalization for Equity and Inclusion: Fostering Sustainability in Education

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Abstract

This study examined the potential of digitalization to advance equity, inclusion and the quality of education, while also fostering its sustainability in the education sector. It aims at levelling the playing field of digitalization that enhances social justice in the framework of quality education by examining the question dealing with how digitalization can be harnessed to advance equity, and inclusion in a sustainable way. The study was designed using a descriptive technique, and adopted a qualitative research approach. A semi-structured interview guide was used as a research tool to facilitate the collection of data. The data was collected from two secondary schools that had access to digital facilities. The study respondents were selected using purposive sampling. Four participants were carefully selected, consisting of two females and two males. Two of them were school leaders, and the other two were students. The collected data was subjected to deductive-inductive iterative analysis in order to identify the relevant codes and sub-codes. The analysis of the data yielded findings that indicated that when effectively implemented, digitalization has the potential to bridge educational gaps, thereby providing marginalized and underserved communities with access to high-quality learning resources. The application of digital tools has the potential to facilitate universal access to information, personalize learning experiences and cultivate a sense of community and solidarity among learners. However, the challenges that must be overcome are numerous in order to facilitate equitable and inclusive digital access and space. These include the digital divide and the necessity for teacher training in digital pedagogy, the shortage of ICT teachers, and unequal distribution of facilities. Additionally, students with disabilities are unable to access digital facilities due to the lack of inclusive digital facilities, which limits their ability to learn effectively. Prospectively, in order to fully realize the potential of digitalization in education, it is imperative that policymakers, educators and stakeholders address the issue of the digital divide. This can be achieved by providing inclusive digital facilities, offering teacher training, hiring more ICT teachers and investing in digital infrastructure.

Keywords: Digitalization, Inclusiveness, Equity, Quality Education, Sustainability

1. Introduction

This paper examines the way in which digitalization can be harnessed to advance equity, inclusion and the quality of education, while also fostering sustainability in the education sector thereby enhancing the playing field of digitalization in regards to social justice in the framework of quality education. Education is pivotal to the realization of the 2030 Agenda for Sustainable Development Goal 4 (UNESCO, 2023), which is exclusively focused on quality education. It ensures inclusiveness and equitable quality education, as well as promoting lifelong learning opportunities for all (UNICEF, 2000). In view of quality education, there is considerable enthusiasm for the adoption and integration of digital technologies in education. Concurrently, digitalization is regarded as a pivotal factor in facilitating educational advancement, enhancing social inclusion and promoting environmental preservation and digital footprints through the advancement of equity, inclusion, solidarity and sustainability (Alam, 2023). Nevertheless, educational inequality persists as a challenge for educational

institutions (Gerard Lynn, 2022). The digitalization of education may give rise to novel forms of exclusion and inequality, contingent on the uneven distribution of digital resources, which in turn engenders disparate access to digital technologies (OECD, 2023). When digital equity and inclusion in education are designed and implemented effectively, the epistemic roll out of digital technologies can be attained and used to support students from diverse backgrounds and enable all students to reach their potential (Mergel et al., 2019; OECD, 2023). This paper will commence in the first part with the background of the study, situate the specific problem and the questions to use for the exploration of the variables in the subject under review. Part two will present the theoretical orientation and a review of related literature. Part three will present the methodology, followed by the presentation of the findings. The paper will conclude with a discussion.

1.1 Background

The advancement of technology appears to be an endless process, driven by human curiosity. Technological advancements have also had a profound impact on various aspects of daily life (Sarah, 2022). One domain of human activity that makes use of digital systems is education. The dynamic landscape of education has witnessed a profound shift from traditional to modern pedagogical paradigms over the years (Chaika, 2023). The traditional education system was predicated on the utilization of traditional pedagogical techniques, which resulted in the inadvertent integration of issues pertaining to inequality and exclusion. In economically disadvantaged countries, primarily concerning the millions of children who are unable to access formal education (Haleem, 2022: Krisztina, & Thorfinn, 2024). Consequently, a big number of young people are hence, leaving school without acquiring any meaningful qualifications while some choose to drop out, perceiving the curriculum to be irrelevant (OECD, 2012; UNESCO, 2015). A review of experiences in numerous countries reveals that persistent social and economic inequalities and educational exclusion can precipitate disaffection, social fragmentation and even conflicts (UNESCO, 2012). Regarding the gap observed, in September 2015, the world adopted 17 Sustainable Development Goals, one of which is dedicated to ensuring access to quality education for all (SDG 4). This goal, as outlined by the United Nations (UNESCO, 2023) aims to provide inclusive and equitable quality education and promote lifelong learning opportunities for all.

Achieving equitable quality education, requires significant enthusiasm for the adoption and integration of digital technologies in the field of education and it has emerged as a crucial instrument for the realization of SDG4. Digital education is the utilization of digital technologies for the purposes of teaching and learning, both within the context of formal and non-formal education, and the infrastructure that is necessary to support such provision (Gerard Lynn, 2022; Mutula, 2024). The digitalization of schools is regarded as a pivotal factor in facilitating educational advancement, enhancing social inclusion and promoting environmental preservation. It enhances digital footprints through the advancement of equity, inclusion, solidarity and sustainability (James, 2023). Digital learning technologies are a powerful instrument that can facilitate improvements in educational outcomes in a number of ways. For instance, they can assist instructors in the generation of instructional materials and provide new methods for learners to engage in learning and collaboration (Abid, 2022; Ahuja, 2023). Compared to the traditional education system, high-tech education supports the inclusion of diverse student groups in education in a number of ways including using the internet to access educational resources, take part in online classes or lecture personalization as was the case during the COVID-19 pandemic, and conduct interactive activities (Pedro, 2023; Reynalen, 2022), enhancing accessibility of educational content, increasing personalization (OECD, 2023).

Africa has experienced a surge in digitalization, with governments and private organizations investing heavily in enhancing digital infrastructure. This has resulted in increased access to the internet and mobile technology, bringing new opportunities for education and skill development (Ford, 2021; OECD, 2021)). As digitalization sweeps across the continent, it holds the potential to democratize education and open doors to new learning possibilities for millions (Ekejiuba, 2023). Nevertheless, developing countries are encountering difficulties in achieving inclusive access to digital facilities due to a number of factors, including: the lack of adequate educational infrastructure which represents a significant obstacle to the integration of digital education in the classroom; absence of educators who are proficient in digital tools, and the high costs associated with digital devices and internet

connectivity present a significant barrier to participation in digital education for many African families. These disparities exist between urban and rural areas, resulting in the formation of a digital divide (Alexis, 2024; Bartholomew, 2024). Addressing these issues is necessary to implement targeted and robust policies and interventions that provide all students with the requisite resources to engage in digital learning (Neetij, 2015; Ekejiuba, 2023). As the Government of Rwanda released its Vision 2050, which emphasises the importance of access to digital facilities and high-quality education as a central component of human capital development, it engenders high expectations from educational stakeholders (GoR, 2012). In this light, it has initiated a number of programs with the objective of promoting digitalization in basic education (REB, 2019). This includes One Laptop per Child (OLPC) project, the smart classrooms initiative, and the empowerment and training of teachers in computer skills as a key component of the government's strategy (GoR, 2012; Molefi, 2024). Notwithstanding these endeavours, the digital divide still persists in Rwanda. It is imperative to acknowledge that when effectively deployed, digitalization has the capacity to bridge educational gaps, thereby furnishing marginalized and underserved communities with access to high-quality learning resources. Nevertheless, when effectively designed and implemented, it has the potential to result in the emergence of new forms of exclusion and inequality (OECD, 2020), which has a significant impact on the educational outcome for students from disadvantaged groups, who often encounter difficulties in accessing and utilizing devices (OECD, 2020; UNESCO, 2017).

A number of institutions specialising in the field of educational technology have contributed to the research in this area. These are the Organization for Economic Co-operation and Development (OECD, 2020), the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2017), the Government of Rwanda (GoR, 2012), have conducted research on digitalization as a path way of achieving sustainable education as in SDG 4. Nevertheless, these studies are still considered inadequate because there is a scarcity of research examining the ways in which digitalization can harness and handle new forms of inequality and exclusion, unless implemented with careful planning across all educational institutions in an equitable manner and the ways in which digitalization can be implemented to enhance the quality of education. The situation in the context of Rwanda remains very challenging irrespective of the robust policy frameworks from the government. At the level of higher institutions of learning, the situation is apparently mitigated, albeit, insufficiently, but at the level of primary and secondary institutions of learning, the situation remains more preoccupying, even if some of these institutions can boast of such infrastructure and devices. This paper will address as question, how digitalization can be harnessed to advance equity, inclusion and the quality of education. In the operationalization of this main research question, the following sub-questions becomes evident;

1. How can digital technologies be effectively utilized to bridge the digital divide and promote equity in education?

2. What are the challenges that hamper the quality of education via the absence of these input factors?

3. What strategies can be implemented to ensure that digitalization fosters inclusive learning environments for all students regardless of their diverse needs and background?

2. Literature review

In this part, the researchers review literature related to the digital technology in education for equitable and inclusive quality education. The reflections were guided by the constructivist theory. This theory enjoins learners at different stages of education to be imbued with productivity and creativity skills, heretofore, espoused in details below;

2.1 Constructivism Theory of Learning.

The constructivist learning theory of Jean Piaget (1896-1980) is founded on the premise that learners construct their own understanding and knowledge of the world through direct experience and subsequent reflection on those experiences. In contrast to a passive reception of information in regards to the banking theory (Freire, 2012), learners engage in the active construction of their understanding, drawing upon their prior knowledge and experiences. Allen, (2022), argues that constructivism is an epistemological view of knowledge. It maintains that knowledge is derived in a meaning-making

process through which learners construct individual interpretations of their experiences, thereby ensuring deep reflections in their minds. Meanwhile, digital education' is used to describe the utilization of digital technologies for the purposes of teaching and learning, both within the context of formal education and that of non-formal education, within a given community. It encompasses the infrastructure that is required to support such provision (Gerard Lynn, 2022), and involves the use of a variety of digital tools, including computers, tablets, smartphones, interactive whiteboards, educational software, online platforms, and internet connectivity, with the aim of enhancing and supporting educational activities (Dron, 2023; Hussian et al., 2017). The correlation between cognitive learning theory and educational technology can be defined by the success of digitization in education as a method of assisting students in the construction and discovery of new ideas, eliminating learning barriers for all students. The utilization of the internet provides students with the ability to access a vast array of educational materials, research articles, e-books, and multimedia content from any location and at any time, through a simple click of a button. However, the simplification of this process presentation makes it a fait-accompli which unfortunately reduces it to a play to the gallery.

2.2 The Challenges Hampering Quality Education

Sustainable Development Goal #4, "Ensuring Inclusive, Equitable, and Quality Education and the Promotion of Lifelong Learning Opportunities for All", encourages inclusive and equitable education environments that provide quality teaching and learning, thereby promoting the desire and opportunity to continue learning throughout life (Sausen & Musabyeyezu, 2020; UNESCO, 2015). Quality education, comprising literacy and numeracy skills, has expanded to include vocational training, developmental skills, disability sensitivity, and qualified teachers, (Beggs, 2012; UN, 2022). Developing countries are falling short of achieving inclusive, equitable, quality education due to misaligned policies regarding funding priorities, a lack of access and inclusion, gender disparities, lack of resources, limited access to technology, physical barriers, lack of parent involvement, curricular constraints, and inadequate teacher training (Alexis, 2024; OECDilibrary, 2023).

The integration of digitalization is believed to be crucial to eliminating discrimination and contributing to quality education and social inclusion. Digitalization, when effectively implemented, can bridge educational gaps, and contribute to the achievement of SDG4 through enhancing access to education, facilitate personal learning, facilitate inclusive education and provide lifelong learning (Gerard Lynn, 2022; OECD, 2023). However, insuring equitable and inclusive digital access is still challenging due to many schools in the rural areas that lack access to ICT equipment and infrastructure (Strudler, 2008). Thus, schools lacking ICT infrastructure cannot benefit from new knowledge, skills and traits that emerge with access to digital technology (Mhlongo, 2023). Moreover, teachers' digital skills are still not enough, and unequal distribution of digital tools. Furtherance to this, qualified teachers and educators who are trained to use digital technology for pedagogical purposes are imperative, (REB, 2019). Failure to addressed in a proper manner, the education system especially in developing countries will continue to falter and exacerbate social and economic inequalities, regarding the case of Rwanda (Alexis, 2024; Gorina et al., 2023). Therefore, anything that may contribute to exclusion, inequality in education needs to be addressed for the economic and social prosperity of individuals and their countries. The acute challenges in the foregoing documents necessitates profound reflection and action.

2.3 Digital Technology, Quality Education and Social Justice

Education is positively the basis for a country's sustainable development in any of its three dimensions: political, socio-economic, environmental, and remains an important factor in eliminating inequalities, exclusion and contributing to poverty reduction and achieving quality education (Abad-Segura, 2020) and resonates with the dictum of Nelson Mandela, who saw education as an incredible weapon that can be used in the transformation of the world. Therefore, this indicates a summative innovative power of education. The experiences from different countries reveals that persistent social and economic inequalities resulted from educational exclusion and can translate to social division and even conflicts (Alharbi, 2022; UNESCO, 2012). Digital technologies in education were adopted and integrated to ensure the achievement of SDG4, insuring inclusive and equitable quality education. It is critical for advancing educational development, increasing social inclusion, and enhancing environmental preservation through promoting equity, inclusion, solidarity, and sustainability, (Alam, 2023). In order

to facilitate a comprehensive understanding we revert to the undermentioned subheadings,

2.4 Digitalization for Quality Education

Disabilities are inherent in every human condition, and it is anticipated that a significant proportion of the population experiences some degree of physical disability or impairment during their lifetime. Once an individual is diagnosed with a disability, it can have a profound impact on their quality of life. In some instances, disabilities can render individuals reliant on others for the basic necessities of life (Olatunbosun, 2024). In general, disability presents a number of challenges which can include the poor level of infrastructure, making it difficult for people living with disabilities to access certain areas, discrimination regarding employment and social opportunity. Individuals with disabilities are subjected to sexual advances from sexual predators, grinding poverty, and restrictions on access to information (Ojedokun, 2012). In view of these hiccups, world leaders introduced 17 Sustainable Development Goals (SDGs), with one goal focusing on the quality of education and the provision of equitable and inclusive opportunities for all (UNESCO, 2015) in addition to EFA (2005).

A variety of policies were considered with the objective of guaranteeing that each student, including those with disabilities, is provided with equal opportunities for involvement, engagement, and achievement in their local public educational institution, thereby enhancing accessibility in the learning environment (Tarabini, 2017). This approach has resulted in the provision of excellent academic opportunities and leading to positive outcomes (Ahuja, 2023)). Digitalization provides a number of avenues for the inclusion of diverse student groups in education. These include the utilization of the internet for the purpose of accessing educational resources, participating in online classes, pursuing online teacher training, accessing online teaching materials and engaging in interactive activities, increasing personalization and providing distance learning opportunities, as was the case during the COVID-19 pandemic (Pedro, 2023; Reynalen, 2022; OECD, 2023). Nevertheless, the digital facilities, especially for students with special needs, are still considered inadequate in all cases, and not all teachers have the requisite skills in inclusive education. Its acuteness in the lower systemic rung of schooling in Rwanda makes it complex and challenging.

2.5 Digital Technology in Education: Benefits and Challenges

The digitalization of education has become a pillar of education policy worldwide, driven by growing optimism that such a policy approach can bestow a wide range of potential benefits to economies and society as a whole (Gerard Lynn, 2022). With the power of the internet and computers, education transcends physical boundaries, it empowers people to read, watch educational videos, and participate in online educational activities, solutions that support both teaching and administrative functions irrespective of their location (OECD, 2023). One of the primary benefits of digital transformation is the ability to provide flexible and personalized learning experiences, which can be tailored to meet the diverse needs of students (Olatunbosun, 2024). Digital technologies can increase accessibility to education for those who may be disadvantaged and vulnerable in society, thereby reducing inequalities in society (Gerard Lynn, 2022). Investing in these technologies is essential to create a conducive environment for digital learning and solution to social exclusion. (Olatunbosun, 2024). It helps the learners to take part in online classes, lectures, and conduct interactive activities (Pedro, 2023; Reynalen, 2022). Hence, it supports the enhancing accessibility of educational content, increasing personalization (OECD, 2023)

Despite the advantages offered by digital technology in the field of education, a number of challenges impede the effective and successful implementation of digitalization in this sector. These challenges can be broadly categorized as, the lack of adequate educational infrastructure, represents a significant obstacle to the integration of digital education in the classroom (OECD, 2020; Mhlongo, 2023), the absence of educators who are proficient in digital tools and the high costs associated with digital devices and internet connectivity engenders a strong barrier to participation in digital education for many in sub-Saharan Africa and visible in urban and rural areas, leading to the upsurge of a digital divide (Alexis, 2024; Olatunbosun, 2024). This issue requires careful attention if the goal is to achieve equitable quality education through digitalization. The failure to address this issues could result in the creation of a new form of social exclusion and inequality.

2.6 Strategies for Implementing Digitalization for Fostering Social Justice

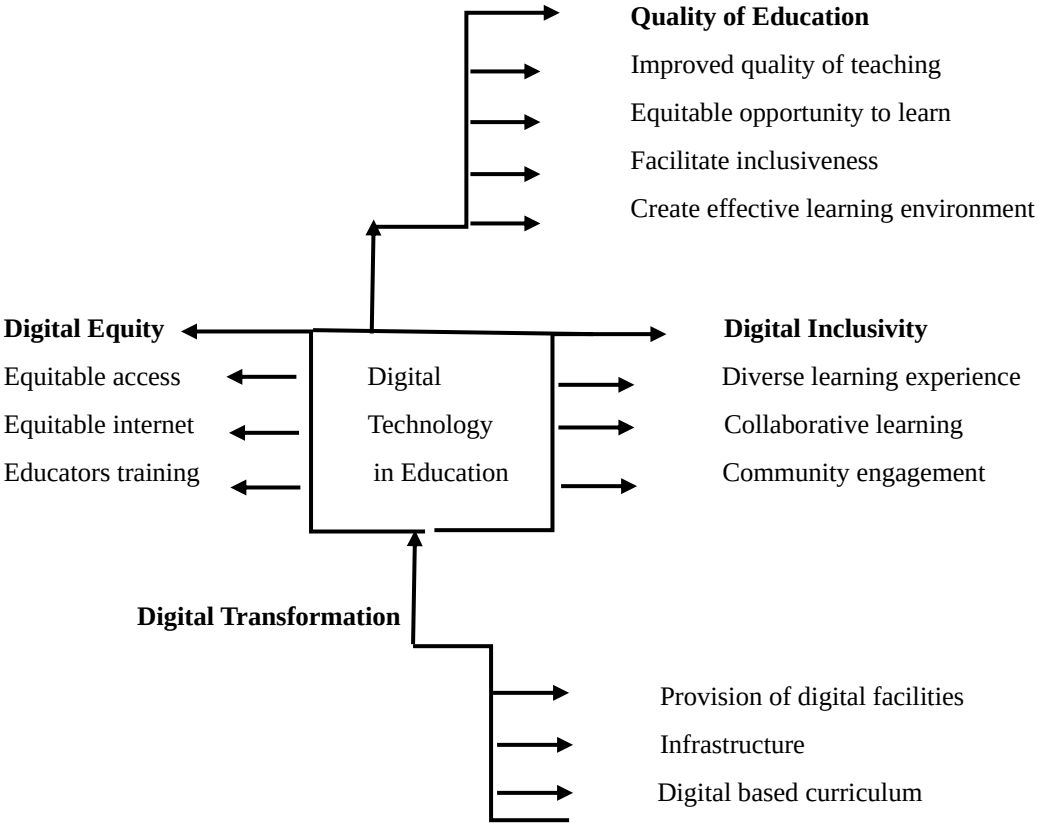
The digital divide, characterized by disparities in access to technology and the internet, poses a significant barrier to the effective implementation of digital education (Gorenšek, 2019; Olatunbosun, 2024). Addressing this issue requires targeted policies and interventions to provide all students with the necessary resources to participate in digital learning. The key strategy is to address the digital divide and ensure equitable access to digital resources and to provide all students from both rural and urban areas with access to the necessary technology and resources (James, 2023; January 2023). This can involve initiatives such as providing low-cost internet or free internet access, distributing digital devices to students and creating inclusive digital content that caters to diverse learning needs (Olatunbosun, 2024). Professional development for educators is another crucial aspect of digital transformation. Educators need to be equipped with the skills and knowledge to effectively use digital tools and technologies in their teaching practices (Joseph, 2024) despite a challenging and complex acquisition of digital tools and availability of requisite infrastructure (Mhlongo, 2023). Continuous professional development programs can help educators stay updated with the latest technological advancements and pedagogical strategies, thus improving their teaching effectiveness and enhancing student learning outcomes (Ahuja, 2023).

The institutions must provide the guidelines, time, space and resources for educators to learn basic and advanced digital technological skills as well as how best to use these technologies in pedagogical settings and embed them in the curriculum (January, 2023.) There is the need for the recruitment of specialise staff to provide technical and pedagogical support both within the educational institution and externally, if remote learning is anticipated (Strudler, 2008).

2.7 Conceptual Framework: Factors for Digital Transformation

In the words of Bas Swaen, (2024.), the conceptual framework is the structure of the study that illustrates the expected relationship between the study variables, indicating the objectives for the research process and shows how they come together to draw coherent conclusions. As the objective of this study is to facilitate a more level playing field with regard to digitalization, thereby enhancing social justice within the context of quality education in a sustainable manner, digital transformation in education is considered an independent factor, while quality education is a dependent factor. The implementation of digitalization in education necessitates the consideration of a number of key initiatives and strategies. These include the adaptation of the curriculum to a technology-based format, the provision of digital facilities and the professional development of educators in terms of educational technology. Consequently, the effective implementation of digitalization in education ensures that all students have equal access to digital resources, thereby facilitating device-based learning irrespective of the background or challenges. Digitalization is pivotal in eliminating discrimination and advancing quality education, social inclusion and equitable economic opportunities. Diagram 1 below illustrates the framework of this study.

Diagram 1: Conceptual Framework: Digital Technology for Quality of Education



Source: Authors Creation, 2024.

3. Methods

Considering the research aim and objectives, a descriptive research design with a qualitative research approach was selected as the design for this study. It was intended to analyses people's perceptions of digitalization in relation to digitalization enhancing social justice in the framework of quality education. A research design as a framework of methods and techniques chosen by the researchers to combine various components of research in a reasonably logical manner so that the research problem is efficiently handled (Khanday, 2023). Therefore, the qualitative research approach was deemed an appropriate methodology for the study.

3.1 Data collection

In this study, the data was gathered from two secondary schools, which have access to digital tools. The researchers employed a non-probability sampling technique, specifically, purposive sampling, to select the respondents. Purposive sampling is a non-probability sampling in which decisions concerning the individuals to be included in the sample are taken by the researchers, based upon a variety of criteria which may include specialist knowledge of the research issue, and willingness to participate in the research (Thapa, 2004). The decision to employ purposive sampling was based on a single primary consideration. It was therefore necessary for the selected schools to have the requisite digital facilities. Two participants were selected from each school, comprising three females and one male (see research ethics). The researchers used interviews as a method of collecting data from the study participants. A semi-structured interview guide was developed for the purpose of data collection. The interview guide was employed to elicit comprehensive information from the study participants. To ensure an appropriate research tool, the questionnaire was vetted by two ICT specialists with content mastery of the concept under review and the two students' participants after receiving approval from their schools to take part were given written permission by their parents.

3.2 Data analysis

In this study, the data collected from the field was audio recorded in Kinyarwanda, with each interview lasting a minimum of 30 minutes and a maximum of 40 minutes. Each interview was translated into English and transcribed by a specialist in Kinyarwanda and English. The average time required to transcribe each audio file was two hours, while the average time spent re-listening and checking for the coherence of the ideas, was one hour. The researchers contacted another language specialist in the two languages to verify the certainty and fluidity of the language to avoid distortion. The transcribed data was read in its entirety on multiple occasions to facilitate familiarity with the material. Subsequently, the data was subjected to coding and highlighting different ideas using different colours, with the objective of identifying sub-codes from the main codes. The primary concepts were identified through the use of codes. The transcripts were then subjected to inter-coding by the researchers. Sub-codes were created for codes that were identified in multiple transcripts and represented the same underlying idea. The data was subjected to an analysis guided by inductive-deductive approach to understand the ontological deontology of these different codes and their practical orientation. It was systematically processed, and interpreted. The analyzes produced insights into the problematic that the study sets out to handle (Hassan, 2024).

3.3 Ethical Consideration

In the data collection process, the participants were shown the recommendation letter, explained the reason for collecting data and reminded of their freedom to refuse to answer any questions they found misleading or uncomfortable. Confidentiality was emphasized and participants were assured that their data would only be used for research purposes. Regarding limitations, the study participants were to be comprised of two females and two males, including two students (one female and one male) and two head teachers (one female and one male). However, on the day of data collection, a male head teacher from one school was unavailable, necessitating the researcher to conduct an interview with his female assistant in charge of studies.

4. Findings

In this part, the researchers analysed and interpret the findings from the study participants. The findings will be presented in accordance to research questions and organised according to the different codes.

4.1 The Profile of the Respondents.

In this study, a total of 4 participants were selected from two secondary schools which were specifically have access to digital facilities. Of the 4 participants chosen, the youngest age was 15-20 while the oldest age was between the age of 40-45. Two participants were students, one a head teacher while the last was as assistant head teacher in charge of studies. All the 4 participants were anonymized in name of the Animals of the week as summarized in the table below:

Table 1. The Profile of Respondents

S/N	Names	Sex	Age	Educational Level	Occupation
1	Lion	Female	45	Masters	Head teacher
2	Tiger	Male	20	Secondary	Student
3	Zebra	Female	40	University	Assistant head teacher in charges of studies
4	Bird	Female	18	Secondary	Student

Source: Primary data, 2024

4.2 The Digital Technologies in Education: Benefits, and Challenges

In this section, the researcher primarily focused on presenting, analysing and interpreting the

respondents' perspectives on digitalization in education. In addressing the initial research question concerning the advantages of digitalization in education, the findings from the study indicated that digitalization remains a pivotal aspect in the educational sector, as evidenced by the following sub-codes: provision of access to online educational content, facilitation of research, equitable learning opportunities and enhancement of digital skills.

4.2.1 Providing Access to Online Education Contents.

The respondents indicated that digital education provides access to online educational content, thereby facilitating the study of phenomena that would otherwise be challenging to access. This is exemplified by the interview with (Tiger, 32, interviewed in September 2024). Such position indicates simplified service provision that is inclusive and easily reachable.

In regard to the utilization of digital resources in the field of education, the participating head teachers concurred that the advent of digitalization has facilitated the teaching process as seen below,

Previously, students were required to complete tasks such as writing examinations on blackboards and designing school reports by hand. However, in the modern era, examination scripts are prepared using machines and printed, thereby eliminating the need for students to face any challenges during the examination process. Similarly, school reports are designed using computers, which has led to an orderly process. (Lion, 98-99 & Zebra, 100-103, interviewed in September 2024). The implication is facilitating, simplifying and enhancing the different teaching and learning processes.

The digitalization also accords students from diverse socio-economic backgrounds the opportunity to engage in research activities. This is evidenced by the following statement,

As students who lack access to digital tools in their family environment, we make use of digital facilities for research purposes when assigned tasks (Tiger, 31, interviewed in September 2024). Digitalisation of the learning process therefore leads to a support mechanism for leaners research abilities, and promoting scholarship that help the learners to have more materials for the acquisition of knowledge.

4.2.2 Provision of Equitable Learning Opportunity

The advent of digital education has the potential to provide both teachers and students from diverse backgrounds with equal learning and teaching opportunities as indicative of this view,

The advent of digital technology in education has created further opportunities for students from disadvantaged backgrounds to continue their studies and demonstrate superior performance on the same level as their peers from high schools (Lion 33-36 & Tiger 31, interviewed in September 2024). As such, social justice is guaranteed, upheld and promoted.

4.2.3 Enhancement of Digital Skills.

The advent of digital technology has transformed the skills of educators in terms of integrating digital resources into the teaching process than was previously the case as evident in the following articulation,

All teachers are equipped with fundamental computer skills, as they utilize digital tools for the completion of school reports through the KAMIS system. This system is accessible to all teachers through the use of computers or telephones. It can be asserted that today, teachers demonstrate an aptitude for integrating technology into their pedagogical practices (Zebra, 94-97, Interviewed in September 2024). Moreover, the process of digitalization in the field of education offers an opportunity to gain fundamental knowledge and understanding of computers (Bird, 33-34, September 2024). Such abilities, and skills acquisition transform the teachers from analogue to digitalism and inadvertently, prepares them adequately for the digital age of the 21st century.

The next question focused on the challenges encountered by educators in their efforts to enhance their digital competencies for all. In response to this question, the following sub-codes were identified; insufficient digital materials, limited time for practice, lack of inclusive digital materials, insufficient ICT teachers including different challenges. In order to facilitate comprehension of these sub-codes, the

researcher identified the following subheadings to ease clarity.

4.3 Insufficient Digital Materials

It emerged from the study that the participants that the digital facilities available for use in the school are still not enough in proportion to the number of students' population. Below is the response to attest to this fact,

We are 2000 individuals, with 40-50 computers accessible for use. However, a proportion of these are not fully operational, and therefore unavailable for use. In view of this, the number of computers is insufficient, and students are required to work in groups or pairs. Therefore, it is not possible for two classes to use the computers at the same time. (Bird, 17-21, September 2024)

The classroom equipped with smart technology has a limited number of computers and is primarily utilized by secondary advanced students, given the relatively high student population (Zebra, 46-48, September 2024). Consequently, the absence of sufficient digital tools makes it difficult to adequately ensure that each learner is able to acquire the requisite skills needed and poses the danger that there may be some students who have not been able to use such digital tools due to their insufficiency.

In the context of inadequate digital resources, it was observed that the quantity of digital facilities serves as a determining factor at the level of accessibility as can be seen from the following excerpt,

Each class has the opportunity to access the computers for one hour in a week (Zebra, 50-51,

September 2024). In view of such challenges, available time hinders the learners from benefitting and accessing to these digital tools and limit study space thereby jeopardizing quality services in the school milieu.

In alignment with the view of Zebra, the students demonstrated that the restricted accessibility of computer resources was a significant barrier to their ability to develop their computer skills, which in turn hindered their capacity to compete effectively in the job market upon completion of their studies, (Bird, 41-42 & Tiger, 49-50, September 2024).

4.3.1 Lack of Inclusive Digital Materials

On the question regarding the accessibility of distinctive digital resources for children with disabilities, with the objective of facilitating their effective learning, all respondents attested to the absence of such resources at present as remarked by all respondents.

The respondent, Lion, provided a comprehensive rationale for the absence of digital facilities for students with disabilities,

It is not feasible to request these resources at this time, as we lack the expertise of a qualified instructor proficient in the operation of these devices. To fully utilize these resources, it may be necessary to engage both the devices and an experienced instructor. Therefore, it would be prudent to redirect the individuals in question to the educational institution that possesses the necessary infrastructure and qualified personnel (Lion, 72-76, September 2024). The problem of inclusivity is more complex and complicated considering the fact that there is the unavailability of digital tools like a brailing machine for the virtually impaired or accepted infrastructure to support them.

4.3.2 Shortage of ICT Teachers

The students demonstrated that the current staffing levels for ICT are insufficient, with only one teacher responsible for teaching students from Level One up to Level Six with a considerable impact on the accessibility of the students, due to the teacher's unavailability or fatigue. (Tiger 59-60 & Bird 47, September 2024). The absence of sufficient trained staff and or personnel limits the learners' ability to appropriate digital tools and work with them. The implication indicates the absence of human capital and requisite infrastructure.

4.3.3 Unequal Distribution of Digital Facilities

The study revealed an inequitable allocation of digital resources among the teaching staff as it was expatiated in the following except.

The government has provided the science teachers with computers. However, they are not accessible to all teachers (Zebra, 90-91, September 2024). This therefore implied that most of the teachers do not have digital gadgets and the probability is their inability to mentor the learners in the absence of these tools.

4.3.4 Unequal Accessibility

In line with limited accessibility, the findings showed that not all students have the same level of access to the computers, which may be a contributing factor to the observed differences in performance. This was clarified by Tiger by postulating that,

It is possible that some students may not utilize the computers for a period of up to one week. However, the students from MPC made greater use of the computers than others (Tiger, 13-15, September 2024). Equity and equality in accessing these tools becomes stalled and unavailable, thereby making it complicated and complex.

Regarding the additional time of accessibility, there is evidence that educators treat the student differently as demonstrated in the following way.

In the event that I want to access the computer, I am granted permission by a teacher. However, other students are not permitted to do so due to their disruptive behavior. To illustrate this, if a student is found to have disobeyed the instructions of an ICT teacher in a classroom setting, the teacher will not grant him/her extra access (Bird, 51-55, September 2024). It shows that indiscipline students are refused accessibility in order not to disturb other students thereby indicating a flaw and shortcoming in managing student discipline challenges. The emerging probability wrest in the program used for professional development of the teachers.

4.4 Strategies for Effective Implementation of Digital Education

The initial research question concerned the strategies for effective implementation of digitalization in education. Hence, the findings from the study indicated the following sub-codes, provision of digital facilities, educators' professional development, increase the number of ICT teachers. In order to facilitate comprehension of these sub-codes, they will be presented using sub-headings.

4.4.1 Provision of Inclusive Digital Facilities

In the context of the digital transformation of education, a variety of digital resources such as computers, projectors and free internet have been made available to educational institutions with the objective of enhancing the efficacy of teaching and learning processes (Lion, 27-29 & Zebra 91, September 2024). The implication of this move indicates a policy shift and innovation geared at aligning educational services provision with up to date initiatives. The effort is praiseworthy though insufficient.

4.4.2 Educators' Professional Development

The educators were equipped with the requisite competencies to facilitate the enhancement of computer skills and the integration of digital technology in education through training. (Lion 30-31 & Zebra, 94-95, September 2024). This shows the resolve of the government to ensure capacity building that leads to a propitious environment with the requisite experts that are needed for educational services provision, which, ultimately enhances sustainability and possibly retention. These ideas from the interviewees are summarized in table 2 below.

Table 2. Summary of the Findings

Codes	Sub-codes	Summary of the finding
Benefit of educational digital technology	Access to educational online content	The utilization of digital technologies facilitates educational improvement and enhances the quality of teaching and learning by providing access to online pedagogical resources.
	Facilitation of research	The advent of digital technology has afforded individuals the opportunity to access vast quantities of information online.
	Provide equitable learning opportunities	The utilization of digital technologies has the potential to enhance the accessibility of education for individuals belonging to disadvantaged groups, thereby contributing to the reduction of societal inequalities.
	Enhancement of digital skills	The integration of digital technologies in the field of education equips students with the requisite skills to thrive in an increasingly digitalized society.
	Smoothing educational service	Digital technologies in education reduce the costs of educational delivery and increase the range, quality and efficiency of educational institutions and the quality of educational management
Factors hampering the successful implementation of educational digital technology	Unequal accessibility	The unequal accessibility to digital facilities provides the foundation for the digital divide.
	Unequal distribution of digital facilities	The unequal distribution of digital facilities gives rise to unequal accessibility and a new form of exclusion.
	Lack of inclusive digital facilities	The lack of digital learning facilities for children with disabilities in school results in ineffective learning for this group.
	Shortage of ICT teacher	The shortage of ICT teachers is a persistent issue that presents significant challenges to the effective delivery of digital competencies to students.
	Insufficient digital facilities	Nevertheless, the digital facilities were made available, yet they are still regarded as inadequate for maintaining the desired level of accessibility.
	Limited accessibility	The limited accessibility represents a significant challenge for educators seeking to effectively utilize digital facilities in order to develop the requisite digital skills.
Strategies for effective implementation of educational digital facilities	Provision of digital facilities	Provision of digital facilities enables the school
	Educators' professional development	Train educators and teachers to improve their competence and skills in the use of digital technologies for teaching and related tasks.
	Provision of free internet	Provide free Internet access to schools, enabling them to access online educational resources and facilitate research.

Source: Primary data, 2024

5. Discussion of the Findings

The different ways in which digitalization can be harnessed to advance equity, inclusion and the quality of education, while fostering sustainability in the education sector has guided this reflection. The ontological deontology was provided from the interviewees perceptions and the extent of their consumption of the digital services provided. The levelling of the playing field of digitalization that enhances social justice in the framework of quality education is assured in principle. In order to facilitate comparison, contrast and the identification of gaps in knowledge derived from the research findings, this section outlines and analyzes and compares the results with existing literature on the subject and what it means.

5.1 Digital Technology in Education: Reflecting the Benefits of Digitalization in Education

The role that digital technology plays in the field of education cannot be overemphasize; it is widely regarded as an indispensable tool in the pursuit of SDG4, which sets forth the objective of ensuring that all individuals have access to high-quality, equitable, and inclusive educational opportunities (UNICEF, 2000; UNESCO, 2023). The study identified a number of benefits associated with digitalization, as evidenced by the fieldwork, which can be summarised thus: access to online educational content, facilitation of research, provision of equitable learning opportunities, enhancement of digital skills and smoothing of educational services that makes sustainability, a fait-accompli. The identification of these sub themes is further expatiated below,

5.2 Access to Online Educational Contents

The digitalization of education has become a cornerstone of global education policy, driven by mounting optimism that such a policy approach can confer a plethora of potential benefits to economies and society at large (Gerard Lynn, 2022). The power of the internet and computers allows education to transcend physical boundaries, empowering people to read, watch educational videos, and participate in online educational activities, facilitating educational improvement and enhancing the quality of teaching. These solutions support both teaching and administrative functions irrespective of location, (OECD, 2023; Pedro, 2023; Reynalen, 2022). Growing accessibility of online educational resources, and the data collected from the fieldwork indicated that digital technology in education provides students and educators with the opportunity to experiment with online materials in order to verify the veracity of claims and reach new conclusions (Lion, 98-99 & Zebra, 100-103, September 2024). This assertion is corroborated by Olatunbosun, (2024) sees digital transformation as the capacity to furnish learners with flexible and personalized learning experiences, which can be adapted to align with the heterogeneous requirements of students irrespective of their trans-cultural stance.

5.3 Provision of Equitable Learning Opportunities

The study demonstrated that digital technologies in education reduce the costs of educational delivery and increase the range, quality and efficiency of educational institutions, as well as the quality of educational management. These findings were supported by Haleem et al., (2022) and Ahuja (2023). This is because they thought that digitalization provides new methods for learners to engage in learning and collaboration whereby, the advent of software applications has opened up new avenues for advancing teaching and learning (Ford, 2021; OECD, 2021). Considering this, Olatunbosun, (2024) see investment in technology as a pivotal step in the creation of an optimal learning environment and the mitigation of social exclusion but ensuring inclusion. As evidenced by the (EU, 2022; Gerard Lynn, 2022), digital technologies have the potential to enhance accessibility to education for those who may be disadvantaged and vulnerable in society, thereby reducing inequalities and preparing citizens to participate and function more fully in a society permeated by digital technologies. Moreover, the findings from the field suggest that the implementation of digital technologies has the potential to enhance the accessibility of education for individuals belonging to disadvantaged groups like poor families, rural areas, disabilities, thereby contributing to the reduction of societal inequalities and equipping students with the requisite skills to compete in the modern job market (Tiger, 32, September 2024). Despite the advantages offered by digital technology in the field of education, numerous challenges impede the effective and successful implementation of digitalization in this sector like unequal accessibility, unequal distribution of digital facilities, lack of inclusive digital facilities,

shortage of ICT teachers, and limited accessibility for want of infrastructure.

5.4 Unequal Distribution of Digital Accessibilities

The unequal distribution was evidenced in the field, which may serve as the foundation for unequal accessibility for students and educators from different digital backgrounds. This could potentially give rise to new forms of exclusion and social inequality. As has been demonstrated, the digitalization of education has the potential to result in the emergence of new forms of exclusion and inequality due to the disparate allocation of digital resources to disparate institutions in disparate circumstances (OECD, 2020). Were (2009) also drew attention to the unequal distribution of digital resources as a significant obstacle to the implementation of digital technologies in the education sector as was observed by (Bird, 17-21, September 2024). Consequently, the process of digitalization is inadvertently disaggregated and leading to unforeseen challenges that may completely mar the initiative. The cognitive flow becomes an anathema due to the inadequate accessibility to the insufficient distribution of digital tools.

5.6 Lack of Inclusive Digital Facilities and the Professionalization of Teachers

Given that students with disabilities encounter a range of obstacles to their quality of education, (see OECD 2020; UNESCO 2020), including social exclusion and discrimination, the advent of digital education has been designed with the objective of facilitating the attainment of equitable quality education for all (Mutula, 2024; Gerard Lynn, 2022). However, the findings indicated that schools remain deficient in digital resources for students with disabilities (Bird, 17-21, September 2024) and that there is a dearth of trained educators in the utilization of inclusive digital resources. This presents an obstacle for effective learning outcomes for students with disabilities. The study by UNESCO (2023) identified several key barriers to effective learning outcomes for students with disabilities. These include a lack of trained teachers in the field of inclusive education, an inadequate supply of facilities and materials. Quality education in the framework of a fast-changing educational landscape in the era of globalization and requires an upgrading of digital skills to teachers, and hence a crucial need for redesigning educational curriculum. In the context of Rwanda, this is already appropriated with the Competency Based Curriculum (CBC) but requiring intense overhaul of educators in a systemic approach. Hence, the epistemic orientation of digitalization in regards to social inclusion becomes defeatist in view of facilities and infrastructures.

5.7 Strategies for Effective and Successful Implementation of Digital Technology in Education

The digital divide characterized by disparities in access to technology and the internet, poses a significant barrier to the effective implementation of digital education (Olatunbosun, 2024). Addressing this issue requires targeted policies and interventions to provide all students with the necessary resources and skills to participate in digital learning (Ahuja, 2023). With regard to the question of effective implementation of digitalization in the educational sector for quality education, the following strategies were possible like provision of digital facilities and educators' professional development as further expatiated below,

5.8 Provision of Digital Facilities

The incorporation of digital technology in education presents substantial benefits in terms of facilitating inclusive and equitable learning opportunities for all (Gerard Lynn, 2022; Mutula, 2024). Were (2009) thinks that the government should take the initiatives of supporting educational institutions with required digital facilities. Such initiatives may include the provision of low-cost or free internet access, the distribution of digital devices to students of all categories, and the creation of inclusive digital content that caters to diverse learning needs. This was demonstrated in the field that schools should be provided with sufficient digital resources for both students with disabilities and without disabilities, enabling them to benefit from digital technology in education. In response to the government of Rwanda's initiative to promote digitalization in basic education, including the One Laptop Per Child programme, the Smart Classroom initiative and the provision of smartphones to teachers, various programmes have been initiated. The objective is to equip all Rwandans with the capacity to enhance their skills and productivity on an ongoing basis (GOR, 2016). These are lofty from the government bench, but attainment remains a quagmire. The provision of digital facilities for human development in terms of digital technology necessitates effective planning and significant

policy to guarantee equal access to digital facilities in more straightforward ways, thus preventing digital exclusion and the development of digital skills-based exclusion.

5.9 Educators' Professional Development

The advancement of professional development for educators represents a pivotal element of the digital transformation process. It is imperative that educators are furnished with the requisite skills and knowledge to utilise digital tools and technologies in an efficacious manner within their pedagogical practices (GoR, 2016; Olatunbosun, 2024). Therefore, Continuous professional development programmes can assist educators in remaining apprised to the latest technological advancements and pedagogical strategies, thereby enhancing their teaching effectiveness and improving student learning outcomes. Meanwhile, the study revealed that educators had received training on the use of digital education to improve educational outcomes for all students, regardless of background. However, is this training robust and of required standards? The situation on ground points to a different direction. Conversely, educators require further training on the use of inclusive digital facilities to achieve the quality of education.

6. Conclusion

Digitalization has emerged as a transformative force in education, offering unprecedented opportunities to enhance equity and inclusion while fostering sustainability. It is a prime mover and educational tool with incalculable advantages though hampered by some unforeseen defects. It has provided key indicators for educational stakeholders thereby ensuring that it services supports equity, inclusion by standardizing it in Education. It has emerged as a transformative paradigm in the education roadmap of the 21st century. It provided unlimited and unparalleled openings by streamlining and promoting equity and inclusion in the educational processes. Through digitalization, systemic defects are slowly marshalled into a thing of the past based on government policies. Its effectiveness is dependent on contextually oriented digital indicators like digital infrastructure, inclusive pedagogy, access, child centred learning as well as socio-economic inclusivity. Such digital interconnecting technology does have its own ethical stance as well as a robust policy anchor.

Consequently, the comprehension of an epistemic morphology of digitalization espouses an advantage and a disadvantage. It will be an advantage cognizant of a successful upholding of equity, inclusiveness and sustainability in the educational landscape. It remains a disadvantage if the necessary infrastructure and human capital development is not standardized. Inclusive digitalization ensures that learners with diverse needs whether due to geographic, economic, or disability-related barriers are not left behind. Furthermore, digital platforms promote lifelong learning and skills development, crucial for adapting to the rapidly evolving global economy

However, achieving it revolves in providing access to online educational content and, consequently, equitable learning opportunities. Moreover, achieving true equity and sustainability through digitalization requires addressing challenges such as the digital divide, data privacy concerns, and the need for teacher capacity-building. Governments, educational institutions, and stakeholders must invest in robust infrastructure, affordable connectivity, and digital literacy programs to bridge these gaps effectively include unequal accessibility and unequal distribution of digital facilities, a lack of inclusive digital facilities, and the need to professionalize teachers.

Digitalization is not merely a technological shift but a catalyst for systemic change in education. When strategically pursued, it engenders democratize learning, empower marginalized communities, and create sustainable educational ecosystems. Moving forward, a creating digital solutions with inclusive and sustainable policies will be key to ensuring that education remains a driver of social equity and global progress.

Recommendations

In view of the fallouts of educational digitalization, it is imperative to provide some implications of this study. It begins with the implications for practice and followed by the possible implications of further research

Implication for Practice

- Endeavour to enhance that all educational institutions are provided all digital services ranging from infrastructure to the requisite devices. This should be approach in a systemic manner without distinction.

- Equity and inclusivity should guide the provision of the different platforms designed in a robust manner with adaptive interfaces to ensure accessibility.

- The training of teachers to acquire digital competences to enable them to integrate these tools in teaching thereby enhancing inclusivity

Implications for Research

- This study was limited to qualitative methods that is by its nature subjective and limited to getting the experiences of the selected sample wherein the results are not generalizable. It is therefore important to undertake a quantitative study with a bigger sample that can be generalize to the entire population

- Another scientific study can be engaged to understand the perceptions of parents on the socio-economic background of the different students on the availability of digital resources and the degree of parent's familiarity with such appliances and use

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