DIGITAL LITERACY AMONG TEACHERS OF LEARNERS WITH DISABILITIES IN KENYA AND THE CZECH REPUBLIC.

BY

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DECLARATION

I declare that this thesis is my original work carried out during my PhD scholarship in the Department of Special Education, Faculty of Education, Charles University (CZ) and has not been presented in any other learning institution for academic certification. Referenced sources have duly been acknowledged. Where text, data (including spoken words), graphics, pictures, or tables have been borrowed from other sources, including the internet, these are specifically accredited, and references are cited using APA 7th edition and in accordance with anti-plagiarism regulations.

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This work is dedicated to my supportive wife Katutuu Ndeveni and my smart children Christian Kavua, Eve Mutanu, Maryann Mwende, and Angela Mutheu.

ABSTRACT

The study focused on establishing how teachers use their digital literacy skills to facilitate learning in Kenya and the Czech Republic. This was achieved by focusing on four objectives: to identify how teachers apply digital literacy skills to facilitate learning; to establish self-efficacy in digital literacy among primary school teachers of learners with disabilities in Kenya and the Czech Republic; to investigate the challenges to the application of digital competencies in class by teachers of learners with disabilities in special primary schools; and to explore how teachers of learners with disabilities overcome the challenges faced in the application of digital competencies. The study was guided by the Self-efficacy element of Albert Bandura's Socio-Cognitive Theory. A descriptive research design was used for the study. The target population for the study was teachers of learners with disabilities in primary schools in Kenya and the Czech Republic. Probabilistic sampling was applied in the study. A semi-structured questionnaire and observation checklist were used to collect data from 456 teachers: 329 from Kenya and 127 from the Czech Republic. A mixed-method approach was used in the analysis, where statistical methods including descriptive, independent sample and chi-square tests were used. Thematic analysis was used to analyse text-based qualitative data relating to one research question. The study found that how teachers in the Czech Republic apply digital literacy to facilitate learning is on average 27% above the common average of the two countries, while Kenyan teachers apply digital literacy to facilitate learning is 15% below the common average. The average score for self-efficacy in digital literacy for teachers in the Czech Republic was 38% above the common mean, while Kenyan teachers were 16% below the common mean. This study established that teachers in both Kenya and the Czech Republic face both personal and institutional challenges that affect their application of digital literacy. Some strategies used by teachers to overcome these challenges are focused on using available resources, seeking funding and support, personal training and professional development, time management and adaptation, collaboration and peer learning, and alternative methods and solutions. The study concluded that teachers facilitating learning for learners with disabilities in Kenyan and Czech primary schools had average self-efficacy, though those from the Czech Republic rated better. It was recommended that they be further trained through in-service programs to improve their self-efficacy in digital literacy. In policy, the study recommends compulsory in-service teacher training in digital literacy.

Key words: Digital literacy, Self-efficacy, Teachers, Learners with Disabilities

ABSTRAKT

Studie se zaměřila na zjištění, jak učitelé využívají své dovednosti v oblasti digitální gramotnosti k facilitaci učení žáků s postižením v Keni a České republice. Disertační práce sledovala čtyři cíle: zjistit, jak učitelé uplatňují svoje dovednosti v oblasti digitální gramotnosti k facilitaci učení; zjistit úroveň vědomí vlastní působnosti (self-efficacy) v oblasti digitální gramotnosti mezi učiteli žáků s postižením na základních speciálních školách v Keni a České republice; prozkoumat výzvy s uplatňováním digitálních kompetencí učitelů na speciálních základních školách; a porozumět tomu, jak učitelé žáků s postižením překonávají výzvy, kterým čelí při aplikaci svých digitálních kompetencí. Studie byla vedena konceptem úrovně vědomí vlastní působnosti dle socio-kognitivní teorie Alberta Bandury. Pro studii byl použit deskriptivní výzkumný design. Výzkumný vzorek tvořili učitelé speciálních základních škol v Keni a v České republice. Ke sběru dat byly použity metody polo strukturovaný dotazník a pozorování, a to u celkem 456 učitelů: 329 z Keni a 127 z České republiky. Pro analýzu dat byly uplatněny statistické metody zahrnující deskriptivní analýzu, testy pro nezávislé výběry a chí-kvadrát testy. Tematická analýza byla použita k analýze textových kvalitativních dat týkajících se jedné výzkumné otázky. Studie zjistila, že způsob, jakým učitelé v České republice aplikují digitální gramotnost k facilitaci učení, je v průměru o 27 % nad aritmetickým průměrem obou zemí, zatímco způsob, jakým keňští učitelé aplikují digitální gramotnost k usnadnění učení, je 15 % pod tímto průměrem. Průměrné skóre v oblasti digitální gramotnosti učitelů v České republice bylo o 38 % nad aritmetickým průměrem, zatímco průměrné skóre keňských učitelů bylo 16 % pod aritmetickým průměrem. Tato studie zjistila, že učitelé v Keni i České republice čelí jak na osobní, tak na institucionální úrovni výzvám, které ovlivňují aplikaci jejich kompetencí v oblasti digitální gramotnosti. Některé ze strategií, které učitelé používají k překonávání těchto výzev, se týkají využívání dostupných zdrojů včetně hledání finančních prostředků a podpory, vzdělávání a profesní rozvoj, řízení času a adaptace, spolupráce, vzájemné obohacování stejně jako alternativní řešení. Studie dospěla k závěru, že učitelé žáků s postižením v keňských a českých základních školách mají průměrnou úroveň vědomí vlastní působnosti, nicméně s lepšími výsledky u českých učitelů. Mezi formulovaná doporučení patří rozšiřovat příležitosti pro kontinuální vzdělávání učitelů v oblasti digitální gramotnosti. Pokud se jedná o systémová opatření, studie doporučuje obligatorní zařazení témat digitální gramotnosti do studijních programů orientovaných na vzdělávání budoucích učitelů.

Klíčová slova: Digitální gramotnost; Vědomí vlastní působnosti, Učitelé; Žáci s postižením

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LIST OF ABBREVIATIONS

ADD	Attention Deficit Disorder
ADHD	Attention Deficit and Hyperactivity Disorder
AU	African Union
BECF	Basic Education Curriculum Framework
CAPI	Computer-Assisted Personal Interview
CART	Communication Access Real-Time Captioning
CBC	Competence-Based Curriculum
CRPD	Convention on the Rights of Persons with Disabilities
CZ	The Czech Republic
DHH	Deaf or Hard of Hearing
DL	Digital Literacy
DLP	Digital Literacy Program
ECDE	Early Childhood Development and Education
EDPB	European Data Protection Board
FA	Factor Analysis
FEPs	Framework Educational Programmes
GDPR	General Data Protection Regulations
HHI	Harvard Humanitarian Initiative
ICT	Information Communication Technology
ICTA	Information & Communication Technology Authority
ILO	International Labour Organization
JRC	Joint Research Commission
KICD	Kenya Institute of Curriculum Development
KIE	Kenya Institute of Education
LWD	Learners with Disabilities
NACOSTI	National Commission for Science, Technology, and Innovation
NCLB	No Child Left Behind
PCA	Principal Component Analysis
SDG	Sustainable Development Goals
SEN	Special Educational Needs
SEPs	School Educational Programmes
SNE	Special Needs Education
SRSWR	Simple Random Sampling Without Replacement
STR	Speech to Text
TALIS	Teaching and Learning International Survey
TDD	Telecommunication Device for the Deaf
TL	Turkish Language
UNGA	UN General Assembly

CHAPTER ONE: INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 Introduction

This chapter encompasses the contextual foundation of the research, an articulation of the research problem, the overarching aim of the study, specific objectives, research inquiries, the significance of the research, constraints and delimitation, suppositions, the theoretical and conceptual framework, as well as the operational definition of key terms.

1.2 Background of the Study

Digital literacy is a prerequisite for successful digitalisation and digital transformation (Rossikhin et al., 2020). Digital literacy is defined as the ability to use digital technologies to assess, manage, understand, communicate, integrate, evaluate, and create information (USAID, 2022; UNESCO, 2018) safely and appropriately. Conceptually, digital literacy is an overarching phrase related to multiple literacies, such as 'media literacy, visual literacy, information literacy, and computer literacy' (Kahveci, 2021; UNESCO, 2018). Digital literacy is regarded as an important skill for citizens because it speeds up learning and saves time and resources (Maulana, 2015). Digital competence and digital literacy have been used synonymously in the context of functional skills in digital technologies (Iordache, 2017).

Digital technologies are increasingly becoming transformative in how people work, learn, communicate, access information, and spend their leisure time (ala-Mutka, 2011). The novel corona virus disease (CoViD-19) accelerated the need for digital technologies to build resilient educational systems. In recognising the rapidly growing need to facilitate learning education, stakeholders around the globe have developed innovative ideas, systems, and concepts to support both teachers and students. For instance, the European Skills Agenda, anchored on the Digital Education Action Plan, aims to (i) promote digital skills and competencies for digital transformation and (ii) foster the development of a high-performing digital education system (Vuorikari et al., 2022). This is per the JRC's (Joint Research Commission – European Commission) Digital Competence Framework for Citizens (DigComp), a reference guideline for the advancement and strategic planning of digital competence initiatives both at the European and Member State level. The DigComp framework was

created to ensure digital literacy among citizens and harmonisation in its development and has since been revised, resulting in DigComp 2.1 (European Union, 2017) and lately DigComp 2.2 (eU, 2022).

As part of the strategies to support the Africa Agenda 2063, the African Union (AU) developed the Digital Transformation Strategy for Africa 2020-2030 (Bayingana, 2020). Both the EU and AU have taken significant policy steps to make digital technologies more accessible. However, while the DigComp framework is the European Union's framework for facilitating practical digital literacy, the African Union is yet to make a significant direct intervention, apart from policy formulation, to ensure that digital literacy takes root on the continent. Policy and practice regarding digital literacy in Kenya and the Czech Republic are likely to be influenced by such policies and practical environments in their respective continents, based on conceptual descriptions by Wahlströ et al. (2018) on international policy actors. According to Wahlströ et al. (2018), external pressure on educational policy has become significant in the past two centuries. For instance, the national strategy for digital transformation in Czechia, implications for persons with disabilities (Šiška, 2021) was developed in the context of the EU's overarching digital strategies. Similarly, the sector policy for learners and trainees with disabilities and special needs (MOE, 2018) in Kenya was drafted in recognition of the changing education landscape to embrace inclusivity and digitization.

The United Nations General Assembly (UN-GA) commits to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (SDG 4). To accomplish this, digital technology can play a significant role. Digital literacy is required to fully realise the potential of digital technologies in education. Therefore, countries that want to achieve SDG 4 should invest in digital literacy. Some countries have taken steps to integrate digital literacy into education. Kenya and the Czech Republic, for example, have both included digital literacy as a core competence in their curricula (KICD, 2017; Kasparova, 2017). However, even with these developments, the focus is on outcomes for learners, without significant consideration of the fact that teachers ought to have digital literacy first to be able to impart the same to the learners.

Before the implementation of the competence-based curriculum (CBC) in Kenya, the primary school teacher training curriculum lacked digital literacy. According to a recent independent study conducted by the International Labour Organization (ILO), only about 81,000 teachers out of over 300,000 were trained in the field (ILO, 2021). As a result, it appears reasonable to conclude that most teachers in Kenyan schools currently have limited digital literacy training and/or expertise (ILO, 2021). Therefore, their ability to impart the same skills as expected to learners may be called

into question. Because digital competencies have been part of the curriculum for primary school students in the Czech Republic for longer, teacher training institutions may have had more time to adjust and include them in their curricula. The respective education ministries in both countries regulate the quality of elementary teacher education and training. Understanding needs to be built by increasing knowledge of digital literacy in both countries, which is limited.

This study aims to establish self-efficacy in digital literacy among teachers of learners with disabilities in special schools in both countries, how they apply those skills in class, the challenges faced in the application of the skills, and how teachers resolve the challenges they face while using digital technologies in class. Special schools are important, as many learners with disabilities are educated in special schools (Denglerová et al., 2022).

1.3 Statement of the Problem

The Czech Republic and Kenya have included digital literacy as a core competence in their respective curricula for elementary education (Ministry of Education, Youth & Sports [MoE, Y&S] (2020), Ministry of Education [MoE], KICD, 2017). The goal to include digital literacy in elementary schools in both countries was to provide students with the knowledge, skills, and attitudes necessary to use digital technologies effectively and responsibly. Achievement of this goal is premised on the assumption that teachers have the requisite digital literacy to facilitate learning and impart the same to students. Available evidence in developed countries, such as the OECD (Organization for Economic Cooperation and Development) report, suggests that teacher education institutions in various countries did not properly handle digital literacy among teacher educators due to ICT questionnaires in previous PISA (Programme for International Student Assessment) studies developed in an ad-hoc way, without a comprehensive ICT assessment framework (OECD, 2019). Krumsvik (2014) contends that global research institutions within teacher education have not paid much attention to digital technology. Given the latest education reforms in Kenya (in 2017) and the Czech Republic (in 2020), with digital literacy as a critical aspect, there is a need to examine the status of digital literacy for teachers of learners with disabilities, as this influences learners' educational prospects. Despite the great geopolitical, cultural, and socioeconomic disparities between Kenya and the Czech Republic, congruence in their educational reforms highlights the realisation of globalisation and digitisation. Furthermore, comparative research on digital literacy between developed and developing countries is scanty, limiting the understanding of potentially existing gaps and useful lessons for sustainable development goals (SDGs). This study sheds light on the discrepancies in digital competence among teachers of learners with disabilities and

eventually points to their training needs.

1.4 Purpose of the Study/General Objective

The purpose of the study was to establish and compare the level of application of digital literacy to facilitate learning by teachers in special primary schools in Kenya and the Czech Republic. The study examines teachers' self-efficacy, ICT skills, academic level, teaching experiences, and their influence on the application of digital literacy.

1.5 Objectives of the Study

i) To identify how teachers apply digital literacy to facilitate learning in special primary schools in Kenya and the Czech Republic.

ii) To assess self-efficacy in digital literacy among special primary school teachers of learners with disabilities in Kenya and the Czech Republic.

iii) To investigate the challenges to the application of digital literacy in a class by teachers of learners with disabilities in special primary schools.

iv) To explore how teachers of learners with disabilities overcome the challenges faced in the application of digital competencies.

1.6 Research Questions

i) How do teachers apply digital literacy to facilitate learning in special primary schools in Kenya and the Czech Republic?

ii) How do teachers of learners with disabilities in special primary schools demonstrate self-efficacy in digital literacy?

iii) Which are the challenges that influence the use of digital literacy by teachers of learners with disabilities to facilitate learning?

iv) How do teachers overcome the challenges they face while using digital technologies to facilitate learning?

1.7 Significance of the Study

Establishing how teachers view digital literacy will provide a foundation for future teacher training and capacity-building programs to raise the capacity of teachers in the identified areas of need. It will inform the reengineering of government policy about gaps in teachers' pre- and in-service

training programs, in line with the existing core competencies of education in both countries. Documenting the challenges that influence teachers' application of digital literacy, and how they resolve the challenges faced while using it, will contribute to new knowledge and strategies based on their creativity in problem-solving.

1.8 Limitations and Delimitations

1.8.1 Limitations

Creswell (1994:110) defines research limitations as "*potential weaknesses of the study",* which according to (O'Leary, 2010) may impact the generalisability of a study. The study focused only on teachers in special schools. Teachers in other types of institutions that serve learners with disabilities were left out of the study. Consequently, the results of the study can only be generalisable to special schools.

Theoretically, two technologically diverse countries were compared in the study. The Czech Republic is comparatively economically and technologically more developed than Kenya, so it could have more resources available for schools to make digital technology available. This could lead to an imbalance in the resources available among schools in each country. However, principles of comparative educational research were followed in making comparisons between the two countries, hence, mitigating potential biases.

Methodologically, the main tool of data collection – a semi-structured questionnaire – was translated from the English language to Czech, hence some meaning in the questions might have been lost in the process. Regarding the observations, researchers take a long time to interact with participants, so they can get accustomed to having them in the setting and reduce the reactivity effects (Cohen et.al. 2000). In this case, the researcher could not spend critical time with the participants to overcome the reactivity effects. These increased chances of participants acting more self-aware during the study observations.

1.8.2 Delimitations

Delimitations are how the study was narrowed down in scope (Creswell, 1994). Participants were limited to teachers of learners with disabilities in special primary schools in Kenya and the Czech Republic. The study confined itself to data from teachers obtained through questionnaires and non-participant observations. Data from learners and other participants in the learning process were not

included in the study.

1.9 Assumptions

The researcher made the following assumptions to guide the study:

i) Respondents will provide all the pertinent information required for the study.

ii) Teachers of learners with disabilities use digital technologies to teach.

1.10 Theoretical and Conceptual Framework

1.10.1 Theoretical Framework

This study is based on the self-efficacy theory proposed by Albert Bandura (1977, 1986, 1997). The self-efficacy element of Albert Bandura's Social-Cognitive Theory was used to guide this study. Self-efficacy is an individual's self-belief in their ability to carry out certain activities or execute courses of action required to achieve certain levels or types of performance. Bandura (1986; 1997) defined self-efficacy as: 'People's judgments of their ability to organise and execute courses of action required to attain designated types of performances. He argued that a person's belief in their ability to achieve something determines how they act towards the achievement of the same. Bandura (1997) asserts that '*individuals play an active role in shaping their own psychological and social well-being through personal agency. One of the most influential factors in personal agency is the belief in one's ability to accomplish goals. When people lack the conviction that their actions can lead to desired outcomes, they are less motivated to act. Thus, the belief in personal efficacy is a fundamental driver for taking initiative in life and making choices*.'

Bandura (1977) hypothesised that self-efficacy affects a person's choice of tasks, effort, and persistence on the task. In line with that, this study hypothesises that teachers of learners with disabilities with high/positive self-efficacy (efficacious) towards digital literacy are more likely to be digitally competent, and more likely to utilise their digital skills to facilitate learning, compared to those with low/negative self-efficacy (inefficacious). Bandura (1986) further posits that efficacious individuals have higher expectations from themselves, and are therefore likely to put in more effort and persist for longer periods when doing more difficult tasks. Therefore, teachers who are effective in their digital literacy are likely to exert more time and effort to apply it to facilitate learning.

The self-efficacy theory is a psychological framework that focuses on an individual's belief in their

ability and capacity to accomplish tasks and achieve the desired outcomes. The tenets of this theoretical framework suggest that self-efficacy plays a pivotal role in shaping various aspects of individual conduct, achievement, drive, and cognitive functioning. Consequently, self-efficacy beliefs possess the potential to manifest as self-fulfilling prophesies within a particular domain, exerting a noteworthy influence on individuals' cognitive processes, perseverance levels, motivational orientations, and emotional states about tasks within that domain (Talsma et al., 2019). Nevertheless, Talsma et al. (2019) acknowledged that these individuals can experience shortcomings when confronted with tasks that exceed their perceived ability to effectively manage and cope.

The self-efficacy theory has had many applications in research and project programming in many disciplines, including education, health and wellbeing, business and leadership and career development. In education research, for example, self-efficacy is thought to be a key predictor of students' motivation and success (Guo et al., 2012; Zee et al., 2018). Studies on business and career development have underscored the association between self-efficacy and key outcomes, such as job satisfaction, professional commitment, and attrition rates within the teaching profession (Demir, 2020; Hong, 2012). Within the teaching profession, a teacher's self-efficacy belief refers to their confidence in their ability to effectively plan and implement strategies that lead to desired improvements in learner involvement and educational outcomes, even when faced with the challenge of instructing unmotivated and challenging students (Kleinsasser, 2014). Christophersen et al. (2016) describe self-efficacy concerning teachers as the teachers' beliefs that they can carry out good teaching in the classroom. The theory of self-efficacy was used in this study, with the assumption that higher teacher self-efficacy in digital literacy correlates with higher application of digital literacy to facilitate learning.

1.10.2 Conceptual Framework

The conceptual framework provides a visual presentation of the structure and relationship between key variables of the study in the context of theoretical underpinning (Varpio et al., 2020). Other researchers, such as Imenda (2014) and Zackoff et al. (2019), describe a conceptual framework as a presentation of interrelated and interdependent components and variables that help solve a research problem through deductive resolution. In this study, the conceptual framework is based on the theoretical framework to illustrate how teachers’ self-efficacy influences their application of digital literacy (DL) to facilitate learning in the context of other intrinsic and extrinsic factors.

The dependent variable in this study is the application of digital literacy by teachers to facilitate learning. This variable is influenced by a set of independent variables, including the teacher's self-efficacy in digital literacy, the teacher's ICT skills, the teacher's highest academic level and the teacher's experience. The differences that can be observed between dependent and independent variables can be potentially explained by a set of moderating variables. In this study, ICT infrastructures in schools, including relevant hardware, software and connectivity to power and the internet, can influence both independent and dependent variables of the study.

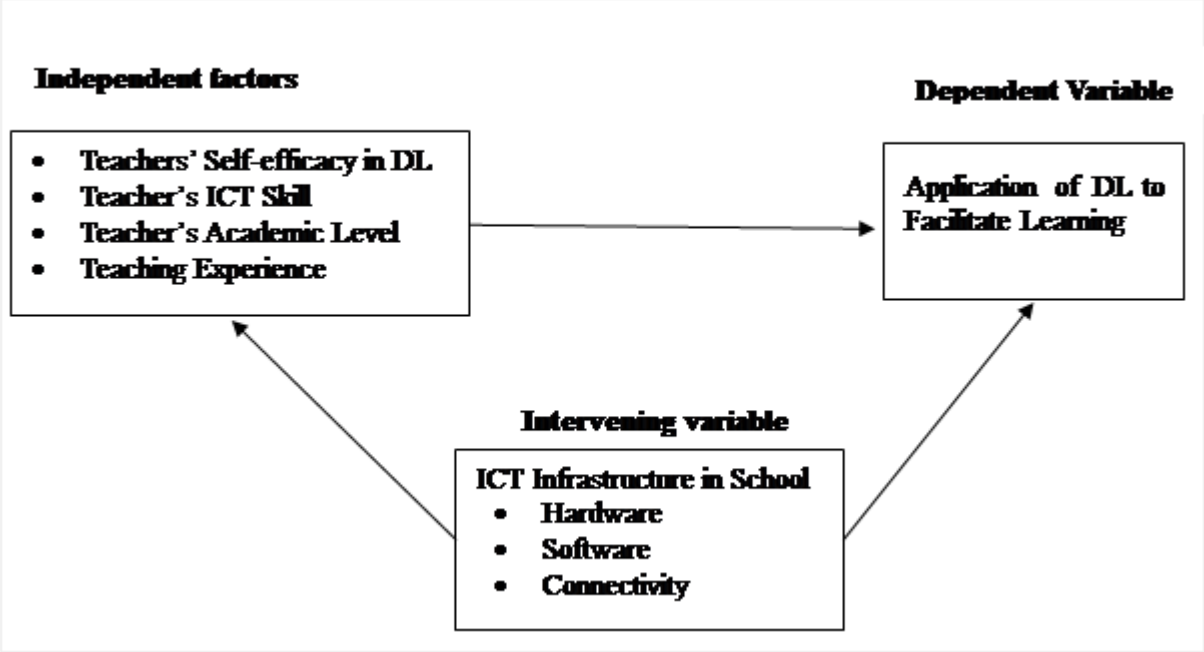

Figure 1.1: Conceptual Framework

Source: Author (2022)

11.1 Operational Definition of Terms

Digital Literacy – a person's ability to identify, assess, and communicate information clearly through digital media on different platforms.

Digital Technology – means any software, hardware or network solutions that enable, extend and support learning, business, or other activities.

Disability – a physical, cognitive, mental, or developmental condition that impairs, interferes with, or limits a person's ability to engage in certain tasks or actions or participate in typical daily activities and interactions.

inclusive School – an institution providing elementary education to all learners regardless of sensory, physical, intellectual, and emotional differences, among others.

Special education – the education of children who are different from the average to the extent that they need adjustments of usual school practices to the extent of the provision in a specialised institution.

Special Needs Education (SNE) – education aimed to assist persons who require extra support and adaptive instructional methods to participate and meet learning goals in a learning programme.

Special Educational Needs (SEN) – a term used to portray learning problems or disabilities that make it difficult for a child to learn compared to children of similar age.

Special school – an institution catering to students with educational needs arising from physical, intellectual disability, psychosocial, behavioural difficulties, health, or other special needs.

CHAPTER TWO:
REVIEW OF RELATED LITERATURE.

2.1 Introduction

This chapter presents a review of literature related to the study, including digital literacy, self-efficacy, disabilities and education in Kenya and the Czech Republic.

2.2 Education in Kenya and the Czech Republic

2.2.1 Digital Literacy in Kenya's Education System

By the chronological calendar, the Kenyan elementary education calendar begins in January and typically ends in November. There are three breaks throughout the year, in April, August, and December, for three terms per academic year. Since 1985, Kenya's education system has provided 8 years of primary, 4 years of secondary, and at least 4 years of university education, dubbed 8-4-4. 'Education for self-reliance' was the guiding principle of the 8-4-4 system. However, after over 2 decades of implementation, the 8-4-4 was criticised for failing to prepare and produce self-reliant graduates. The curriculum was criticised for being overly academic, overburdened, and exam-focused (Kavua, 2020). These difficulties prompted the establishment of a curriculum review process in Kenya (KIE, 2009). This paved the way for a new education system described as the Competency Based Curriculum (CBC).

The Odhiambo Commission was established to align Kenya's education with Vision 2030, Kenya's development master plan. The Odhiambo report (Ministry of Education [MoE], 2012) proposed a new curriculum, which led to the Basic Education Act (2013). The process culminated in the development of the Basic Education Curriculum Framework (BECF), which incorporates a Competence Based Curriculum (CBC) motivated by different policies, including the Kenya Vision 2030, the Kenyan Constitution of 2010, the KICD needs assessment report (2016), and the Sessional Paper Number 1 (2019).

Despite Kenya signing the SDGs, the 8-4-4 system did not include components of digital literacy as a core goal in its content for learners. The introduction of the CBC changed the situation (KICD,

2015). Learners in Kenya must acquire digital literacy as a core competency derived from basic education curricula. Teachers, on the other hand, have significant gaps in their digital literacy. According to the website of Kenya's ICT authority, 80,980 teachers were trained in basic ICT skills in 2009 (ICTA, n.d.). Given the country has over 300,000 teachers, approximately 27% could be said to have received basic ICT, related knowledge, and skills training by 2019.

In Kenya, special schools primarily educate learners with disabilities from kindergarten through secondary school, as well as technical training. This follows the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), to which Kenya is a signatory. Implementation of the UNCRPD in Kenya has influenced education policy and practice, including efforts by the government to improve access to quality education for students with disabilities by developing guidelines for inclusive education and providing support services, such as assistive devices, specialised training for teachers, and curriculum adaptations (Kavua, 2018; Kavua, 2020). Kenya has enacted the Access to Information and Communication Act (2019) and the Persons with Disabilities Act (2020), which require public buildings, transportation, and information and communication technologies to be accessible. Efforts have been made to make public spaces, transportation systems, and government services more inclusive.

The Kenyan government launched the Digital Literacy Program (DLP) in 2013 to equip learners with 21st-century skills. By 2018, the DLP had trained approximately 27% of Kenyan teachers. This figure was, however, revised upwards in 2021, indicating that 100% of teachers had received ICT and CBC training. Other than this report, there is no empirical research to support this assertion, otherwise, there would have been no need for the large-scale in-service training that occurred since its inception (Fahrurrozi et al., 2019). The BECF rollout assumed teachers were well prepared to handle the new core competencies for learners. Typically, teacher preparation and training would come before the implementation of a new curriculum. This study provides empirical evidence of teachers' levels of digital literacy to facilitate decisions about their ability to assist learners in achieving the competencies they are expected to have. Given that basic pre-service training for teachers in Kenya does not include digital literacy, and that digital literacy is not one of the requirements for becoming a teacher, it is reasonable to assume that most Kenyan teachers might not be digitally literate.

To achieve the CBC's goals and objectives, learners must master seven core competencies. The areas include effective collaboration and communication, critical and creative thinking, creative thinking and imagination, civic engagement, digital literacy, developing the ability to learn, and

belief in personal efficacy (KICD, 2019). As is evident, digital literacy was considered a core competence due to the vital role it plays in achieving other educational goals (Information & Communication Technology Authority [ICTA] online, n.d.). The seven core competencies were considered critical in enabling the 21st-century Kenyan citizen of the world to thrive (Fahrurrozi et al., 2019).

2.2.2 Digital Literacy in the Education System in the Czech Republic

The school calendar in the Czech Republic typically follows a pattern like other European countries, where an academic year begins in early September and ends in late June or early July. The Czech Republic has been working towards the inclusion of students with special educational needs into mainstream schools (Bendová & Fialová, 2015). The reforms aim to give equal opportunities to all learners, regardless of their abilities, and promote inclusive education practices. In the last two decades, the Czech Republic has implemented several education reforms in the elementary sector to improve the quality of education and adapt to changing societal needs. As a member state of the European Agency for Special Needs and Inclusive Education, the Czech Republic has implemented education reforms that acknowledge inclusive education as a vital component of more socially inclusive societies.

Specialized support and individualised education plans are developed to address the specific needs of students with disabilities or learning difficulties. Recent curriculum reforms in the Czech Republic have highlighted the development of key competencies among students (Greger & Walterová, 2018). These competencies include communication and social skills, critical thinking, creativity, and digital literacy. The goal is to prepare students for the challenges of the modern world and enable them to actively participate in society. Enhancing digital literacy among teachers, including those in special schools, is vital for equipping students with the necessary skills for the digital age (Langer, 2017).

The Czech Ministry of Education, Youth and Sports developed a National Digital Education Strategy for the period 2021-2027. This strategy outlines the vision and goals for digital education in the country, focusing on areas such as infrastructure development, teacher training, digital resources, and the integration of technology in teaching and learning processes. The strategy emphasises the importance of digital literacy and aims to prepare students for the challenges of the digital era. Efforts have been made to provide teachers with comprehensive training and professional development prospects to increase their digital literacy skills. The Czech Republic has

implemented various initiatives and programs to equip teachers with the knowledge and skills necessary to integrate digital tools effectively. These programs cover topics such as digital pedagogy, online resources, information literacy, and data protection. Institutions like the National Institute for Education established in 2011 focus on pedagogical-psychological, educational and career guidance and counselling, as well as on initial prevention of risk behaviour, while constantly working to raise the quality of these services (NÚV, 2011).

Significant investments have been made to improve digital resources and infrastructure in Czech schools. Efforts have been made to enhance internet connectivity, upgrade computer labs, and provide access to digital tools and resources (Černochová & Novotná, 2020). This initiative helps promote collaboration and exchange of best practices among educators.
The Czech Republic actively participates in international cooperation initiatives to promote digital literacy in education. For example, the country is part of the European eTwinning program, which facilitates collaboration between schools across Europe through digital platforms (Vuorikari et al., 2022). This program encourages the use of technology to connect students, teachers, and schools, fostering digital literacy and intercultural dialogue.

In the last two decades, the Czech Republic has implemented several education reforms in the elementary sector to improve the quality of education and adapt to changing societal needs. Such reforms include the Education Act 2004, which introduced significant changes in the Czech education system, such as student-centred learning, the National Curriculum Framework (2007), which focused on competency-based education, promotion of inclusive education, and embracing the integration of technology in education. Additionally, the Czech Republic has made significant steps to implement the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) to promote and protect the rights of people with disabilities. These include ratification of the UNCRPD in 2009, and enactment of legislation to align its national laws with the principles of the UNCRPD, such as Social Services and Equal Treatment Acts, National Disability Strategy, and Inclusive Education.

Efforts have been made to ensure that digital literacy initiatives in the Czech Republic are inclusive and cater to the needs of all students (Bendová & Fialová, 2015). The focus is on providing accessible digital resources, addressing the digital divide, and promoting inclusive practices. Special attention is given to students with disabilities, with initiatives aimed at adapting digital tools and resources to their specific needs, fostering their digital literacy skills. Despite the effort and significant steps made by the Czech Republic in digital literacy, there are limited empirical studies

that focus on a comparative analysis of how teachers apply digital literacy to facilitate learning in the Czech Republic and other countries. Hence, this study sought to bridge this gap by comparing Kenya and the Czech Republic.

2.3 The Concept of Digital Literacy and Competence

This section examines the relationship between digital literacy and digital competence within the context of the present study. An examination of existing literature uncovers various definitions for these two constructs. Firstly, Fahrurrozi et al. (2019) define digital literacy as an individual's ability to locate, assess, and effectively communicate information using writing and other media formats across diverse digital platforms. In contrast, Ala-Mutka (2011) characterises digital literacy as an evolving form of literacy that surpasses the combined essence of information literacy, internet literacy, media literacy, and computer or ICT literacy (encompassing knowledge and skills related to hardware and software). The Basic Education Curriculum Framework (BECF) of Kenya aligns with Ala-Mutka's perspective by incorporating traditional literacies alongside computer literacy within the notion of digital literacy. UNESCO (2018, p. 6) defines digital literacy as:

> "…*the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately through digital technologies for employment, decent jobs, and entrepreneurship. It includes competences that are variously referred to as computer literacy, ICT literacy, information literacy and media literacy."*

According to Redecker (2017), digital competence encompasses the confident, critical, and creative use of ICT to accomplish tasks related to work, employability, learning, leisure, social inclusion, and active societal engagement. It is considered a fundamental, cross-cutting competence that facilitates the development of other essential competencies, such as language proficiency, mathematical skills, the ability to learn, and cultural awareness. Furthermore, digital competence is strongly associated with the acquisition of various 21st-century skills necessary for active participation in both the societal and economic realms. In the Kenyan context, digital competence is defined as the aptitude to effectively apply relevant knowledge and skills to successfully carry out a specific function (KICD, 2015). According to this definition of competence, digital competence could be defined as the ability to apply appropriate knowledge and skills to successfully perform functions using digital technology, which is consistent with the UNESCO (2018) adopted definition of digital literacy. Thus, both terms could be used interchangeably.

In recent European policy recommendations, there are two slightly distinct interpretations of the term 'competence'. According to the Key Competences Recommendation, 'competence' is a

combination of skills, knowledge and attitudes that are suitable and applicable to a particular context (European Parliament and Council, 2006). Conversely, within the framework of the European Qualifications Framework suggestion, the notion of 'competence' represents the most advanced level of sophistication among the framework forms. It is defined as the demonstrated ability to effectively utilise knowledge, skills, personal, social, and/or methodological abilities in practical work or study settings, while also considering professional and personal improvement. Furthermore, competence is defined in the European Qualifications Framework by assuming responsibility and exercising autonomy.

Although the two terms can be used interchangeably, there appears to be a geographical divide in their application. Spante et al. (2018) conducted a systematic review of 107 peer-reviewed research articles that revealed regional differences in how the terms digital literacy and digital competence were used. Digital literacy was used in the United Kingdom/Ireland, the United States, Africa, and Asia while most publications defining digital competence originated in Continental Europe, dominated by Spain, Italy, and Scandinavia, as well as South America. It is worth noting that most English-speaking countries prefer digital literacy to digital competence in their publications. In this study, these terms shall be used interchangeably given their common reference to a common concept of digital skills and knowledge within the context of self-efficacy.

2.4 How Teachers Apply Their Digital Literacy to Facilitate Learning.

The impact of ICT on education, particularly in research teaching and learning, cannot be overstated (Achimugu et al., 2010). With the rapid increase in the digital revolution in the learning environment, there is a growing demand for teachers to use their digital literacy skills to facilitate learning (Rusydiyah et al., 2020). In this context, teachers' digital literacy, skills and competencies become important in their teaching abilities. Rusydiyah et al. (2020) contend that how teachers use technology to facilitate learning is a function of their computational thinking, information, and media awareness.

Megahed and Hassan (2022) explored a blended learning model as one of the best ways how teachers can use digital literacy to facilitate learning in the post-COVID-19 era. According to this study, teachers can integrate technology into their teaching by selecting appropriate tools, resources, and platforms. These observations align with previous research findings that highlight the potential advantages of ICT in expediting, enhancing, and intensifying skills acquisition, fostering learner

motivation and engagement, bridging the gap between educational experiences and professional work practices, and cultivating economic viability for students in their future roles as workers. Furthermore, the integration of ICT is shown to contribute to educational improvement and facilitate transformative changes within schools (Pannen, 2015). Whilst basic education is required for a person to access and apply digital technology in a rapidly changing world, teachers may need a more in-depth understanding of how to harness the power of their digital literacy and integrate the same into their pedagogical practices.

In traditional educational settings, textbooks have long been central to coursework, with teaching primarily focused on content delivery. Lectures, presentations, tutorials, and introductory activities have been utilized by teachers to reinforce and practice the presented material. However, contemporary educational settings increasingly prioritize competency and performance-driven curricula. Rather than solely focusing on the acquisition of information, these curricula emphasize the application and utilization of knowledge. The integration of ICT strongly supports these evolving requirements, and numerous exemplary instances exist worldwide where ICT has been effectively harnessed to facilitate competency and performance-based curricula (Sharma, 2015).

In the context of special schools, the integration of digital technologies has the potential to invigorate both teachers and students. By providing curricular support in challenging subject areas, digital technologies can contribute to the improvement and enhancement of educational quality. To achieve these objectives, teachers need to engage in collaborative projects and participate in the development of intervention strategies that incorporate the use of ICT tools. Additionally, three preconditions must be met for teachers to successfully introduce and utilize ICT in their classrooms: they must have confidence in the effectiveness of technology, believe that its implementation will not disrupt the learning process for students, and feel a sense of control over the new technological resources (Cheung & Slavin, 2012).

Despite recognizing the value of technology, research indicates that a substantial number of teachers fail to harness its potential to enhance learning environments (Butler et al., 2018). The benefits of ICT technology become evident only when teachers, who possess confidence in their abilities, are open to exploring new avenues for transforming their classroom practices through its integration (Jamieson-Proctor, 2018). Consequently, the use of ICT not only enhances learning outcomes but also equips the next generation with the necessary skills and preparedness for their future lives and careers (Wondemtegegn, 2018). This emerging cohort of teachers will carry new responsibilities and require a distinct set of skills for future instruction, characterized by a greater emphasis on ICT

and a shift towards more facilitative teaching roles rather than didactic approaches (Dart et al., 2017).

The integration of ICT resources into learning and teaching processes offers temporal and spatial flexibility, thereby fostering increased interaction and information assimilation in educational contexts (Baskin & Williams, 2006). Such possibilities necessitate changes in communication approaches and instructional methods adopted by teachers, paving the way for novel scenarios that promote individual as well as collaborative learning within schools. The utilization of ICT resources within educational settings acts as a catalyst for transformative change, encouraging and supporting independent learning among students.

The influence of technology in augmenting learners' capabilities is poised to further expand. Historically, the teaching process has centred around educators meticulously organizing and guiding learners through a series of instructional sequences aimed at attaining predetermined learning objectives. Such instructional methods have conventionally revolved around the deliberate dissemination of knowledge, followed by interactions intended to reinforce the acquisition of knowledge. However, contemporary learning approaches leveraging modern information and communication technology (ICT) offer a multitude of possibilities for constructivist learning. These approaches facilitate resource-based, student-centred learning environments that promote the connection of learning to real-world contexts and practical applications (Damşa & De Lange, 2019).

The integration of ICT resources within educational environments facilitates various facets of knowledge construction, and their impact becomes increasingly evident as more learners incorporate ICT into their learning processes. Teachers strategically leverage ICT to augment the learning experience, aiming to create meaningful and captivating educational encounters for their students. Learners derive satisfaction from their studies and appreciate the opportunities for independent inquiry that arise from innovative and suitable utilization of ICT. However, the adoption of ICT remains limited in most schools, primarily restricted to computer classes and administrative tasks (Dart et al., 2017). ICT resources encompass hardware, broadcasting technologies, and crucial software that enhances both teaching and learning processes (Kakkavas et al., 2020). For the effective exchange and dissemination of data and information between teachers and learners, it is imperative to establish computer networks and internet connectivity to interconnect ICT resources. A networked school extends beyond mere physical network infrastructure, as it actively incorporates external sources whenever feasible (Rodrguez et al., 2019).

The utilization of ICT resources, including ICT curricula, directly influences the outcomes and outputs of ICT implementation in educational settings. These resources play a crucial role in transforming teaching, learning, and assessment practices for both teachers and students with special educational needs (Hersh, Leporini, & Buzzi, 2020; Masih, 2018). Educational institutions and educators are widely recognized for their ongoing efforts to enhance pedagogical approaches, student learning experiences, and assessment methods. Given the increasing prevalence of ICT today, the integration of ICT into educational systems at all levels becomes imperative (Lowder & Regmi, 2020).

Information and communication technologies have permeated various aspects of society, profoundly impacting daily routines. The integration of ICT into teaching, learning, and assessment holds the potential to drive transformative changes in special schools, while also establishing connections between educational policies and economic and social development (Rana & Rana, 2020). Moreover, substantial evidence highlights the transformative influence of digital technology on the learning processes of students and the teaching methodologies employed by educators, as well as the flexible nature of when and where learning takes place (Masih, 2018). In educational reforms worldwide, ICT skills have been identified as indispensable, underscoring the necessity for educational reforms in both developing countries like Kenya (since 2011) and developed economies such as the Czech Republic, which have emphasized the integration of ICT resources within schools.

Learners with disabilities and special educational needs necessitate inclusive learning experiences that foster higher levels of reflection, creativity, independence, cooperation, and mastery (Medina et al., 2021). When ICT resources are effectively employed, teachers, students, and parents/guardians can collectively develop and enhance these vital skills (Hersh et al., 2020). However, integrating ICT into the teaching, learning, and assessment of students with disabilities poses a complex challenge, as the mere presence of ICT within schools does not guarantee its effective utilization (Enrique, 2018).

As is the case with other countries in Sub-Saharan Africa, Kenya has incorporated ICT into its educational policies over time (Muinde & Mbataru, 2019). However, there is a lack of empirical research that demonstrates the specific impact of ICT on enhancing learning outcomes in Kenya. Nevertheless, the Kenya National Education Sector Plan for 2013-2018 placed considerable emphasis on the integration of ICT (Piper et al., 2015). This strategic plan was developed in response to the implementation of the National ICT Policy in 2006, which aimed to enhance the

accessibility of efficient, affordable, and dependable technology services across various sectors of the economy (Republic of Kenya, 2006). Acknowledging the significance of ICT in education for the realization of Kenya's development blueprint 'Vision 2030,' the government distributed tablets to all grade one students in public primary schools (Muinde & Mbataru, 2019). Subsequently, curriculum reforms were introduced to equip every learner in the country with essential competencies and world-class digital literacy skills required for success in the twenty-first century (Maluei, 2019).

Undoubtedly, the integration of technology into society has become increasingly pervasive. It is challenging to identify any activity that has not been influenced by modern technology. Smartphones equipped with GPS navigation have revolutionized travel by car, bike, or foot, while the ubiquity of apps has become a testament to society's reliance on technology. From weight loss to entertainment, a plethora of apps and downloads cater to various needs. Furthermore, smartphones allow families to control home utilities and facilitate video conferencing apps like Skype and Google Meet for virtual meetings. Social media platforms enable loved ones to connect, share memories, and bridge geographical distances through pictures and videos. With the world at our fingertips, technology has shrunk the boundaries, enabling access to global news and the ability to purchase valuable artwork with a single click.

Given the success of technology in all facets of life, the question arises within the education sector: "Why not in education?" If technology has propelled the success of other industries, should it not also benefit students who have grown up surrounded by it? Active student participation in the learning process leads to better retention, and technology facilitates greater student engagement in education (Vannatta & Beyerbach, 2000). Extensive research has been conducted to explore the advantages of integrating technology into the classroom, with numerous studies attesting to the significant benefits for students, teachers, and administrators (Jhurree, 2005).

The integration of technology in education presents several benefits to communities and society at large. These advantages encompass an enhanced learning environment, a valuable tool for supplementing traditional classroom instruction, administrative support for teachers, improved access to inclusive education, a communication platform, and a means to cultivate a competitive edge in the global economy (Jhurree, 2005). In the twenty-first-century classroom, any advantage that contributes to an enriched learning environment is highly valued. Educators are leveraging technology to augment the learning experiences of their students. The novelty of modern technologies or learners' familiarity with them can heighten engagement and motivation, thereby

facilitating task completion. Technology enables students to interact with their academic work in a more meaningful manner, gain a clearer comprehension of its quality, and readily embrace feedback (Riasati et al., 2012, p. 26). Moreover, the presence of technology in the classroom can alleviate student anxiety (Riasati et al., 2012). Additionally, teachers can harness technology for administrative tasks such as student record-keeping, lesson planning, assessment creation, and data dissemination. Microsoft Office, for instance, provides a range of programs specifically designed to streamline teachers' responsibilities, simplifying once time-consuming tasks.

Beyond administrative duties, technology assists teachers in multiple ways. It provides students with disabilities greater access to education, aligning with the overarching goal of inclusive schooling. Technologies such as laptops and tablets have facilitated integration within traditional classrooms (Ertmer et al., 2012). Many schools possess computer labs and mobile laptop labs that teachers can utilize. Additionally, students can bring their technology from home, further incorporating technology into the classroom. In addition, a diverse array of software applications is now available to provide assistive technology support for students with disabilities. The advent of the internet and email has revolutionized global communication, enabling teachers and students to engage with classrooms worldwide in real-time, irrespective of geographical barriers. Moreover, parents can be easily reached and involved in their children's education, regardless of their physical location.

Furthermore, contemporary employment opportunities in the global economy necessitate a fundamental understanding of modern technology. Students who have access to technology within the classroom gain a competitive edge in the job market. Hands-on experience serves as the most effective means of acquiring technological proficiency. Daily utilization of technology fosters a sense of self-monitoring among students, thereby increasing their likelihood of accomplishing tasks (Riasati et al., 2012, p. 26). The subsequent sections of this literature explore the diverse array of technological resources found in educational settings.

2.4.1 Laptops

In the past two decades, there has been a significant surge in the popularity of laptop computers. a recent survey conducted by Baker (2012) revealed that 90 per cent of college students surveyed own a laptop computer. as highlighted by Bayless (2013, p. 132), educators are encouraged to incorporate technology in the classroom, serving as role models, and occasionally allowing students to utilize their own devices. The widespread availability of technology has brought forth numerous

opportunities for classroom teachers that were previously inaccessible. However, it also presents new challenges. according to Bayless (2013), several law professors have implemented a ban on laptops in their classrooms, providing three general arguments to support their stance. Firstly, laptops do not enhance the effectiveness of notetaking. Secondly, students tend to be less engaged in class and exhibit reduced interest in active participation when laptops are permitted. Lastly, the presence of laptops can be distracting not only for the users themselves but also for those seated close (Bayless, 2013, p. 124). irrespective of whether the impact of laptops is positive or negative, it is undeniable that the availability of this technology has profoundly transformed the educational landscape in an unprecedented manner in recent history.

One of the challenges that teachers must tackle pertains to the effective integration of technology. The widespread adoption of laptop computers in classrooms can give rise to complications if educators lack professional training in utilizing these tools. These issues can subsequently impact the overall effectiveness of teachers. Teacher effectiveness encompasses various critical aspects essential for fostering a professional environment conducive to teaching and learning (Battle, 2008). The proficiency of educators in effectively leveraging the available resources is one among several factors influencing curriculum effectiveness (Carlson & Reidy, 2004). With the proficient integration of tablets and laptops in the classroom, the possibilities for educational engagement expand exponentially. Technology, previously regarded as a potentially isolating force, is now recognized as a primary avenue for connectivity and taking control of one's learning (Johnson et al., 2009).

Laptops and tablets have become integral components of the curriculum in many school districts. Increased investments in hardware and software by local, state, and federal funding sources demonstrate a strong commitment to integrating technology in the classroom (Bayless, 2013). Extensive research suggests that these technologies have had a substantial impact on student learning. As indicated by Bayless (2013), laptops have fostered heightened engagement among students in wireless classrooms by facilitating diverse writing activities, analytical reading exercises, and the utilization of media-production software. Recent studies have also shown highly favourable responses towards tablets. In addition to offering the advantages of laptops, tablets boast an extensive array of available applications. Even without accessing the full range of mobile apps, tablets serve as compact video players with immediate access to a vast content library. They function as digital readers for books, magazines, and newspapers, facilitate real-time two-way video communication, enable convenient photo sharing and viewing, and serve as efficient tools for email correspondence and web browsing. Furthermore, tablets offer rich, comprehensive gaming

platforms, all within a sleek, lightweight, portable package that easily fits into a purse or briefcase. However, it is important to note that traditional keyboards are notably absent from tablet devices (Johnson et al., 2012).

Teachers often encounter challenges when attempting to translate technology integration from theoretical classroom settings to actual practice. Clark's (2013) research findings support this observation, as they revealed that although students achieved high grades, indicating competence in using technology, their initial confidence in utilizing the technology was unusually low. additionally, when student teaching portfolios were evaluated, there was limited evidence of technology integration. The presence of various distractions associated with technology in the classroom often acts as a barrier to effective integration. addressing all these distractions proves to be a formidable task for teachers.

The disconnect between learning and effectively implementing the use of laptops and tablets can be attributed to several barriers, prominently among them being the multitude of distractions that these technologies introduce into the learning environment. Bayless (2013) highlights activities such as checking and sending emails, engaging with social media, following sports scores, shopping, playing games, and reading news articles, all of which can occur while the instructor is attempting to conduct a class. These distractions significantly hinder the learning process.

Another obstacle to successful laptop integration in the classroom is the maintenance and repair of technology. in certain instances, public schools have devoted more time to repairing laptops than training teachers on their usage. This misplaced emphasis on computer resources over faculty development hampers effective implementation (Bayless, 2013). it is essential to recognize that the functionality of a technological tool is only as valuable as the competence of the user operating it. Thus, the focus should be on providing teachers with the necessary training and support to utilize technology effectively in their instructional practices.

2.4.2 Mobile Devices

Smartphones and other portable devices, such as tablets and smartwatches, have evolved into versatile tools encompassing personal mobile computers, cameras, game systems, and more. Their multi-touch interfaces, GPS capabilities, and support for third-party applications have rendered them increasingly adaptable for social networking, learning, and productivity (Windshitl & Sahl, 2012). These devices have become indispensable in daily life, serving as essential aids for

transportation, communication, research, and entertainment. The rapid pace of innovation in this field continues to expand the potential of these compact devices, challenging conventional assumptions regarding their usage and presenting new options with each successive generation of mobile phones (Johnson et al., 2009).

Educational applications have significantly broadened the range of capabilities offered by these devices, prompting many educators to incorporate them as learning tools in the classroom. This integration allows students to relate the curriculum to real-world issues, enhancing their understanding (Johnson et al., 2012). in 2009, cell phones were owned by 84% of high school students and 60% of middle school students, indicating their widespread prevalence (Engel & Green, 2011). Given that most higher education students, as well as a huge portion of K-12 students, possess these mobile devices, it is logical to leverage this easily accessible technology within the educational curriculum. While mobile devices have become ubiquitous in society, their utilization to support learning in schools is a recent concept (Bernacki et al., 2020). However, their integration into classrooms is steadily increasing. Observation of student mobile device use revealed that class participation increased when cell phones were employed, as students felt more engaged by using their phones to contribute to the lesson through comments, answers, or research (Engel & Green, 2011).

One frequently cited reason for heightened classroom participation is students' familiarity with smartphones. Since students rely on these devices in their daily lives, they possess a thorough understanding of their functionalities and are naturally inclined to explore and comprehend how they operate. According to Marzano (2003), when students find activities interesting, they are more likely to engage for extended periods. Consequently, activities that students find enjoyable and personally meaningful tend to be the most motivating (Marzano, 2003). The incorporation of smartphones and other mobile devices into lessons has the potential to improve students' grasp of the material.

In a survey, 67% of students emphasized the importance of mobile devices for academic success and reported using them for educational purposes (Gikas & Grant, 2013). another study encompassing 975 faculty and students from universities in New York, North Carolina, and Texas discovered that 90% of respondents owned a laptop computer and 99% possessed smartphones (Cochrane & Bateman, 2010). These findings reinforce the widely held belief that smartphones are valuable tools or distractions that have become deeply ingrained in our lives. Consequently, educators must develop effective policies to address the appropriate use of smartphones.

The utilization of smartphones in the classroom offers a multitude of advantages. Gikas and Grant (2013) conducted research demonstrating that smartphones enable customized information transfer, empowering students to leverage their existing skills and knowledge to achieve educational objectives (p. 26). These devices enhance the process of information transfer by affording students control over how they engage with the presented data. Greenhow (2011) suggests that incorporating social media tools in learning environments fosters a student-centred approach. Furthermore, smartphones have proven effective in engaging learners through features such as constant connectivity, facilitating collaborative learning, and enabling authentic learning experiences on the go (Gikas & Grant, 2011). The mobility provided by smartphones ensures that students maintain a continuous sense of connection to the information they require, regardless of their physical location.

2.4.3 Internet Searching in Education

The emergence and expansion of the internet have led to a significant revolution in the research landscape of society. The quantity of available data is immense and growing at an alarming pace. The volume of data present on the internet and the World Wide Web is already overwhelming, and its exponential growth is evident, with a staggering 2.5 quintillion bytes of data being generated each day. Notably, 90% of this data has been generated within the past two years (Barnaghi et al., 2012, p. 2). This inundation of data has directly influenced research practices within educational contexts, as teachers and students increasingly rely on the internet as a primary source for both research purposes and lesson planning. The instantaneous access to extensive repositories of information provided by the internet has made it an invaluable resource in educational settings.

While the accessibility of the internet has brought significant advantages to educators and researchers, it has also introduced new challenges. one such challenge lies in the instructional approaches employed by educators in response to the internet's proliferation and its diverse resources. Traditional education has often adopted a standardized approach, treating it as a transformative process applicable to all students, regardless of their unique learning styles. However, the emergence of digital natives, a new generation of students who are adept at using computers, phones, and other technologies, has disrupted this conventional model. These students may possess a higher level of familiarity with these technologies than some teachers. Consequently, their preferred mode of learning has evolved, necessitating a shift towards student-centred approaches rather than traditional teacher-centred methods. Modern students appear to thrive under personalized instruction that caters to their individual needs, marking a departure from the

generalized instruction of the past. as such, the role of the teacher has shifted from that of a mere transmitter of information to that of a facilitator, supporting a constructivist approach that aligns with this student-centred paradigm (Thomas, 2011).

The internet is widely recognized as one of the most influential tools ever devised by humankind. However, its power does not solely stem from its technical infrastructure, but rather from the collective efforts of its users, who create, share, collaborate, and act in unison (Waks, 2014, p. 216). While this tool has transformed education in numerous ways, not all opportunities presented by the internet prove beneficial to educators. For instance, the presence of laptops in classrooms has been associated with diminished learning outcomes and a decrease in student's perception of their education (Bayless et al., 2013). The availability of copious amounts of information and the ubiquity of social media presents numerous challenges for both educators and students, as they grapple with the need to multitask and maintain focus on both the teacher's message and the information they are concurrently engaging with via the internet.

2.4.4 Text Messaging in Education

Text messaging has emerged as a convenient and expeditious means of communication among individuals, fostering the notion that this technology could prove beneficial in educational settings. However, for many educators, the opposite seems to hold, as text messaging has garnered a reputation as a significant source of distraction within the classroom. in fact, according to a survey conducted by Bayless et al. (2013), 73.7% of professors consider students reading text messages during class to be the most prominent distraction, while 66.7% identify students sending text messages as the primary disruption to the educational environment. educators also raise concerns regarding the adverse impact of text messaging on students' writing abilities. While text messaging facilitates communication through shorthand and symbols, such an informal communication style does not effectively translate into academic writing. it is unfortunate that despite these concerns, the potential of text messaging remains untapped within the classroom.

Notwithstanding the criticism text messaging has received for its role in classroom distractions, there exists a realm where this technology can contribute to the learning process. Text messaging offers supplementary activities that complement and interact with the conventional methods employed by educators, holding the potential to enhance student engagement. activities such as polling, posting questions, and engaging in short-answer writing, among others, can utilize text messaging to involve every student in the class, as opposed to a limited few who typically

participate in a traditional discussion (Ravizza et al., 2012). By leveraging the technological capabilities provided by text messaging, teachers can now foster greater participation and engagement from a significantly larger number of students in the learning process.

2.4.5 Application of social media in the classroom

The surge in popularity of social media platforms has been remarkable. one contributing factor to this growth is their ability to facilitate personalized learning experiences. Through social media, individuals can access a vast array of videos, opinions, and other information, which can be curated and presented to suit their specific needs (Poor, 2012). This mode of communication has gained significant traction in the field of education over the years. a recent survey conducted among over 1,000 college and university faculty members nationwide revealed that more than 80% of respondents utilize social media in some capacity (Blankenship, 2011). Notably, many of these faculty members incorporate social media both in their professional and personal lives, with 30% using it for student communication and 52% employing it to share multimedia resources such as videos, blogs, podcasts, and wikis (Blankenship, 2011).

Evidence suggests that social media can have positive impacts on education by fostering increased student engagement and interest (Blankenship, 2011). Students are more likely to participate when they are familiar with the tools and platforms being utilized, and statistics indicate that most students are highly acquainted with social media. Furthermore, social media provides a more interactive and dynamic platform compared to the traditional blackboard used in classrooms. another advantage is that it empowers students to take greater ownership of their learning process and assume responsibility for their education (Blankenship, 2011).

In the 21st century, social media platforms exert an increasingly influential role in society, serving various purposes including entertainment, training, and networking. extensive research suggests that students are integrating social media into their academic experiences, both in formal and informal contexts (Dabbagh & Kitsantas, 2012). This integration is not limited to specific demographic groups but has witnessed a rise among students of all ages. as a result, both students and instructors have been impacted by this trend. a survey conducted among teaching faculty in higher education revealed that all participants were aware of major social media sites, with over three-quarters of them having visited a social media site for personal use within the past month. additionally, half of the faculty members had posted content on social media platforms (Moran, Seaman, & TintiKane, 2011). This widespread adoption of social media has also influenced the field of education, with a

substantial number of faculty members utilizing these platforms to enhance their instructional practices. Despite certain concerns surrounding privacy, a majority of faculty members recognize the substantial benefits associated with incorporating social media into their teaching methodologies.

The trend of turning to social media is not limited to educational purposes alone. individuals of all age groups are increasingly relying on the internet to fulfil needs that were previously met through more interpersonal interactions. internet dependence has grown across all age groups, with significant numbers of individuals in various age categories, including teens, young adults, and adults of different age brackets, actively using social media platforms (Lenhart, Purcell, Smith, & Zickuhr, 2010). Surveys indicate that over 90% of individuals under the age of 65 have engaged with social media (Lenhart et al., 2010).

To effectively harness the educational potential of social media, individuals must possess self-regulation skills in their learning process, such as goal setting, time management, and progress monitoring and evaluation (Dabbagh & Kisantas, 2011). Notably, YouTube currently stands as the most popular platform for internet video distribution, while Pinterest provides users with the ability to curate collections of photos called "boards," serving as extensive catalogues of web-based objects. These websites empower individuals with internet access to freely share ideas and videos with friends, family, and the global community. Both platforms are user-friendly and offer a wide range of information.

2.4.6 YouTube and Pinterest as Training Modules

The rising popularity of YouTube and Pinterest among the public has led to an increase in the utilization of these platforms for educational purposes. Many individuals now turn to these websites to access instructional resources covering a wide range of topics, from basic household repairs to extensive renovation projects. These platforms, particularly YouTube, have introduced new requirements and opportunities for learning (Dubovi & Tabak, 2020). With over 65,000 daily uploads and more than 100 million video views, YouTube has experienced consistent growth since its establishment in 2005 (Godwin-Jones, 2007). Learners who seek guidance from platforms like YouTube need to be familiarized with how to effectively navigate these sites. However, the primary advantage lies in the availability of instructional videos covering various subjects, often presented in a step-by-step format with visual aids such as videos and images. Despite the increasing popularity of these videos, it remains unclear whether these websites can truly benefit education-

related endeavours.

Conversely, these platforms present prospects for fostering student-centred learning experiences, enabling learners to leverage their diverse learning styles to enhance their comprehension of the instructional content (Dubovi & Tabak, 2020). This trend facilitates the customization of instruction to cater to individual learning needs. While these websites are commonly utilized in informal educational settings, studies indicate that YouTube videos are increasingly being referenced in published academic research (Kousha et al., 2012). Jones and Cuthrell (2011) conducted a study investigating the potential applications of YouTube in academic research, with a particular focus on how learners engage with the platform.

YouTube has become a preferred platform for professors to deliver lectures to students who are unable to physically attend class, as observed in recent studies (Kousha et al., 2012). These video lectures offer a learning experience that closely resembles the traditional classroom setting. An example highlighting the extensive utilization of YouTube in education is the University of California, Berkeley's YouTube channel, which offers over 3,000 video lectures. Various academic disciplines have explored the integration of YouTube videos into their classroom instruction, including women's studies, language learning and teaching, musicology, history, agriculture, engineering, computer science, chemistry, sports sciences, dentistry, and nursing education (Kousha et al., 2012). The widespread adoption of YouTube across diverse fields underscores its potential as an additional platform for educators to disseminate knowledge and engage with their students.

YouTube is transforming the communication methods employed by many college lecturers, providing students with a more captivating means of accessing lecture content. However, despite its growing popularity, there remains a lack of understanding regarding the motivations behind lecturers' utilization of social media as an educational tool (Roodt et al., 2014). Further exploration is necessary to comprehend how YouTube and other social networking platforms can effectively complement traditional teaching methods in academia. YouTube has been recognized as an innovative and cost-efficient approach to bridging the communication divide between tech-savvy students and their instructors (Abell, 2011). Leveraging this platform for personal use enables students to harness a familiar tool in their academic pursuits.

YouTube has introduced a dedicated educational section called YouTube EDU, which features lectures and educational content from various colleges and universities. This platform allows qualified teachers to contribute their materials. The success of YouTube in the academic sphere has

prompted other websites to follow suit. Big Think, for instance, offers lectures by renowned speakers, politicians, and business leaders on diverse subjects (Gilroy, 2009). Additional websites such as Education for All and Academic Earth have also emerged, providing students with access to lectures and learning resources through online file-sharing services. These platforms have gained significant popularity among colleges worldwide, as institutions recognize their potential for both marketing and learning purposes (Gilroy, 2009). By utilizing online social media and file-sharing websites, colleges can create online communities that cater to students' preferences and demonstrate that learning can occur anytime and anywhere. According to the Pew Internet and American Life Project, 52% of Americans have watched or downloaded online videos, and 20% watch online videos regularly (Little, 2011).

2.4.7 Document Cameras

For a long time, teachers relied on overhead projectors to share graphs and notes with their students. However, many consider the document camera to be an upgraded and improved version of this technology. Unlike overhead projectors, document cameras offer much more functionality. They can serve as both projectors and grading tools when used in conjunction with specialized software. Document cameras can even be used to record lessons, as demonstrated in a previous study conducted in 2013. This recording feature allows absent students to catch up on missed lessons and provides an opportunity for other students to enhance their understanding of the topic (William, 2011).

2.5 Application of Digital Technologies in Special Needs Schools

The twentieth century witnessed significant technological advancements that resulted in the development of a diverse array of highly advanced technologies and assistive devices, particularly catering to individuals with disabilities. This era has brought forth a level of realism and achievability in technologies that do not necessitate external assistance and can be operated by individuals with disabilities, an unprecedented milestone in history (Bohman, 2012). The current capabilities of technological innovations have unquestionably broadened our comprehension of the interaction between humans and technology, with a particular focus on individuals with disabilities. A diverse array of assistive technologies has revolutionized the ability of individuals to independently participate in various aspects of life that were previously inaccessible to them. Prominent examples include computerized speech synthesizers, which facilitate communication for individuals with speech disorders or limited articulation abilities. Additionally, screen readers and

other text-to-speech software have been specifically designed to assist individuals with visual impairments in accessing and understanding written content. Motorized wheelchairs have empowered individuals with physical impairments to seamlessly integrate into mainstream social activities without relying on manual assistance. Speech-to-text software, on the other hand, caters to the needs of individuals with deafness or hearing impairments. These represent just a few examples of the numerous assistive technologies available to support individuals with various disabilities.

ICT plays a crucial role in ensuring the provision of high-quality education to students with special needs. By facilitating the smooth functioning of the teaching and learning process, ICT effectively caters to the diverse abilities of students and promotes their active engagement. The utilization of ICT in the realm of special needs education yields positive outcomes across various domains, including language development, physical abilities, behavioural aspects, social interactions, emotional well-being, and other relevant areas. It is important to note that each student's utilization of ICT in special education is tailored to their unique requirements, with careful consideration given to the specific ICT tools that best address their individual needs. The focus of ICT implementation in special needs education revolves around applications that specifically cater to the needs of students with disabilities.

Recent research by Alper and Goggin (2017), MacLachlan et al. (2018), and Siegel and Dorner (2017) emphasize the beneficial role of ICT and assistive technology in enhancing the overall quality of life for students with special needs. Furthermore, integrating ICT effectively into the learning environment can yield advantages not only for special needs students but also for their mainstream peers. Consequently, special education teachers must equip themselves with a wide range of effective teaching techniques and strategies that can positively impact students with special needs. According to Hutchison and Reinking (2011), the integration of ICT in the learning experiences of special needs students is particularly effective in fostering comprehension, as it encompasses diverse learning styles such as auditory and visual modalities. Given the inherent individual differences among students, accommodating various learning styles through the utilization of ICT is highly valuable in facilitating their understanding and learning outcomes.

The incorporation of multimedia and visual components in educational settings has been shown to enhance students' attraction, interest, and active involvement in the learning process, thereby promoting exploration and comprehension (Shaharuddin & Ahmad Khairi, 2011). Additionally, the utilization of multimedia and visual elements contributes to improved retention of processed information among students. Through the integration of text, graphics, audio, and other multimedia

components, learners' emotions and affective experiences can be influenced, thereby enhancing motivation, and fostering a sense of realism and relevance in the learning environment (Jamalludin & Zaidatun, 2003). ICT in education plays a pivotal role in facilitating seamless and effective teaching and learning experiences (Andin & Hazman, 2010). By leveraging ICT tools, educators can optimize instructional processes and enhance engagement among students (Kamis & Khalid, 2017).

Numerous research studies have been conducted to explore the impact of ICT on the learning outcomes of students with special needs. For instance, Gregor et al. (2003) developed the Seeword software specifically designed to aid children with dyslexia in reading texts. Their findings revealed that the implementation of the Seeword application enabled children with dyslexia to achieve more accurate reading outcomes compared to traditional book-based reading methods. Similarly, Van der Molen et al. (2010) conducted a study to evaluate the effectiveness of the Odd Yellow application in enhancing memory capabilities among students with memory impairment. The intervention utilizing this ICT application yielded noticeable improvements in memory recognition among the participants. Additionally, Wilson et al. (2006) designed The Number Race, a computer game aimed at enhancing the numeracy skills of students who frequently struggle with mathematics. The implementation of this game-based intervention demonstrated positive outcomes in improving the numeracy skills of the targeted student population.

Although previous research has shown that ICT can help students with special needs in many ways, teachers' perceptions of ICT have a strong influence on their use of ICT in the classroom. Teachers' perceptions of ICT are closely related to the incorporation of ICT in teaching and learning activities, as well as the challenges teachers face when implementing ICT in education (Hutchison & Reinking, 2011). According to Wang (2012), teachers' perceptions of ICT use may explain how they perceive, understand, and interpret ICT use in learning. In short, teachers' perceptions are critical in determining whether ICT integration in education is successful (Apeanti, 2014). As a result, to understand the practices of integrating ICT in the classroom, teachers' perceptions, acceptance, and attitudes toward the use of ICT must be studied (Hutchison & Reinking, 2011).

Smith (2011) put forth the notion that the educational utilization of ICT holds immense potential for empowering alternative teaching methods that challenge the conventional hierarchies within the educational system. A notable shift has occurred in the roles of teachers, transitioning from a teacher-centred instructional approach to a student-centred learning paradigm. Traditionally, teachers were perceived as authoritative figures responsible for reciting information, acting as

subject matter experts, possessing sole decision-making authority in the classroom, relying on verbal transmission of knowledge during lessons, and serving as evaluators of student knowledge, among other responsibilities (Starkey, 2010; Archambault & Barnett, 2010).

In educational models that integrate ICT, the roles of teachers undergo a significant transformation, positioning them as facilitators of learning and collaborative inquiry with the support of technology. Furthermore, teachers assume the role of developers of educational materials based on ICT to enhance pedagogical interventions. As emphasized by Law et al. (2011), teachers facilitate learning by creating and adapting multimedia teaching materials utilizing ICT, which encompasses both fundamental and advanced educational software. Their primary responsibility revolves around fostering reflection and exploration of learning activities, experiences, and tasks within the educational process, rather than making decisions on behalf of the students. Various ICT tools, such as videos, films, animations, cartoons, and simulations, are utilized to facilitate learning in diverse ways. Moreover, according to Zhang et al. (2011), the utilization of ICT enables teachers to develop a fresh perspective and acquire a deeper understanding of their subjects.

The conventional roles of teachers in facilitating collaborative inquiries with the integration of ICT have also undergone notable transformations. In the traditional model, teachers assume a guidance role; however, the utilization of ICT empowers them to foster collaborative learning activities where learners engage with one another, thereby reducing their dependence on teachers in this aspect (Tondeur et al., 2008). ICT opens assorted opportunities for collaborative learning, encompassing teleconferencing and video conferencing, email communication, interactive whiteboards, and social media tools, as well as educational software designed for the development of reading, writing, listening, and speaking skills, among others. With the integration of ICT in the classroom, teachers no longer serve as the sole source of knowledge acquisition for students (Ulmane & Ozolina, 2011). Nevertheless, as noted by Niess (2013), teachers can still retain control over the utilization of ICT in these scenarios. They maintain responsibility for outlining educational objectives, evaluating the implementation processes, and monitoring students' academic progress.

Numerous studies have underscored the significance of integrating ICT into pedagogy in terms of shaping and transforming teachers' pedagogical perspectives. Watson (2001) proposed that technology can align with a range of teachers' theories. Teachers are increasingly recognizing the educational potential of recent technologies and actively seeking ways to incorporate them into their classroom practices. Mishra and Koehler (2006) suggested that ICT can be utilized by teachers to develop innovative approaches to presenting subject matter in more accessible and comprehensible

formats, foster purposeful interaction, and enhance the efficiency of knowledge transfer within pedagogical contexts. The integration of multimedia simulations, smart boards, web-based hypertexts, animations, and educational videos, for instance, may offer novel avenues for teachers to embrace the requisite pedagogical knowledge. Law et al. (2011) outlined how ICT empowers teachers to adapt and refine their pedagogical knowledge. Teachers can leverage ICT to design new instructional materials and learning activities, thereby necessitating the acquisition of the latest information and its integration into their existing pedagogies. Moreover, instead of relying heavily on conventional paper-based assessments, teachers can employ ICT for assessing students' knowledge and monitoring their learning progress. The adoption of new assessment systems may give rise to new forms of success criteria. Consequently, teachers may need to familiarize themselves with interpreting ICT assessment results and understanding their pedagogical implications (Lim & Chai, 2008).

Despite the potential for slow progress, contemporary education is observed to be shifting towards student-centred learning, challenging the belief that students are passive recipients of information (Richardson, 2008). The use of ICT to enhance students' educational achievements reflects a shift from traditional teacher-centred learning to student-centred learning. Means and Olson (1997) define student-centred learning as the utilization of technology to foster student learning through collaborative engagement in authentic, complex, multidisciplinary tasks. This approach involves providing realistic and intricate environments for student inquiry, furnishing relevant information and tools to support the investigation, and connecting classrooms to facilitate joint exploration (Means & Olson, 1997, p. 9). According to the literature, ICT can assist students in transitioning from mere data reproduction and basic skill acquisition to constructing mental representations of meaningful knowledge (McAlister et al., 2005). Students can acquire information collaboratively by interacting with experts, peers, extracurricular resources, and technological tools, and critically analyze facts related to their learning. This active engagement allows students to undertake various tasks and employ new strategies to dynamically transform knowledge (Andrews et al., 2007).

2.5.1 Audio-Visual Information Transferring through ICT

The utilization of both audio and visual modalities concurrently has been demonstrated to enhance cognitive abilities in students with hearing impairments. Lalonde and McCreery (2020) emphasize the significance of appropriately aligning audio-visual information for users of hearing aids, as auditory signals may be compromised, necessitating heavy reliance on visual cues for knowledge transfer. Jesse and Massaro (2010) conducted research illustrating that speech recognition is more

effective when individuals can perceive both the auditory and visual aspects of a speaker's communication, as opposed to relying solely on visual or auditory information in isolation. This is attributed to the fact that audio-visual materials provide complementary information about speech segments and facilitate effective listening to a speaker, a phenomenon known as intermodal synchrony, involving the use of multiple modes of communication (Liu & Sato, 2009; Desai, Stickney, & Zeng, 2008). However, it is important to note that the use of hearing devices may present certain drawbacks, such as delayed signal processing and potential asynchrony between audio and visual cues in telecommunications materials.

Furthermore, it is important to acknowledge that the perception of audio-visual asynchrony can be influenced by the severity of hearing loss (Lalonde & McCreery, 2020). Research suggests that students with moderate hearing loss tend to rely more on auditory information compared to those with severe to profound hearing loss (Fitzpatrick et al., 2019; Bess et al., 2020; Wong et al., 2017). However, some studies have found evidence indicating that students with severe hearing loss may demonstrate better utilization of residual hearing in auditory speech comprehension compared to students with moderate hearing loss (Liu & Sato, 2009). Several factors contribute to this variability, including the age at which hearing device usage is initiated (Watson, Archbold, & Nikolopoulos, 2006), the quality of auditory education received, and the effectiveness of hearing devices (Lalonde & McCreery, 2020). Consequently, students with deaf or hard-of-hearing impairments may exhibit varying levels of auditory speech perception skills depending on the severity of their hearing loss (Jizzakh, 2020; Wong et al., 2017).

According to Lalonde and McCreery (2020), students with hearing impairment (DHI) who heavily rely on visual cues may experience functional changes in the brain, such as cortical reorganization, and enhanced perception of motion and peripheral stimuli. empirical studies have consistently demonstrated that students with DHI exhibit superior performance in tests of spoken language perception when exposed to combined audio-visual information, compared to conditions involving either auditory or visual stimuli in isolation (Jesse & Massaro, 2010). in a study conducted by Gori et al. (2017) specifically focusing on audio-visual speech perception in students with DHI, an open-set sentence comprehension test was administered to explore the circumstances under which students demonstrated enhanced performance. The results revealed that students exhibited improved performance when speech was presented in an audio-visual format, surpassing performance in both the audio-only and visual-only conditions. Remarkably, no significant difference was observed between the audio-only and visual-only conditions. This suggests that students with DHI undergo multisensory development that is contingent upon the mode of information presentation.

Furthermore, the study found that students' proficiency in audio-visual presentations was correlated with their performance in audio-only tasks about spoken word recognition and various speech competencies. Thus, the ability to comprehend audio-visual inputs is not isolated or independent from other speech and language skills but rather reflects shared properties of the broader language processing system itself (Gori et al., 2017, p. 7).

In an elementary school setting, Massaro and Light (2004) conducted a study involving students aged 8 to 13 with congenital moderate-to-profound hearing loss. The study aimed to integrate a computer-animated character named Baldi, also referred to as a "talking head." Baldi was utilized to provide training in single consonant and consonant clusters, along with concurrent speech therapy. The implementation of Baldi spanned 21 weeks, with participants receiving 6 hours of training per week. To assess the impact of the intervention, examiners rated the intelligibility of the students' utterances against the target text using pre-and post-tests. The results demonstrated a significant improvement in the speech production abilities of students with DHI following the implementation of Baldi.

In a study conducted by Wu et al. (2007), a computer-based auditory training program was employed to enhance vowel, consonant, and tone recognition skills in students with hearing impairment (HI). The study involved ten participants aged 5 to 10 years old. initially, the students' baseline recognition abilities for vowels, consonants, and tones were evaluated. Subsequently, the participants engaged in a computer program that presented them with numerous monosyllabic words for 30 minutes per day over 5 days during a 10-week implementation phase. Upon comparing the results to the baseline measurements, the student with Hi exhibited significant improvements in all three aspects: vowel, consonant, and tone recognition. While some students demonstrated higher proficiency in vowel recognition compared to consonant recognition, six out of the ten students showed improvement across all three conditions.

2.5.2 Speech Recognition Technology

The advent of new ICT devices has brought forth a multitude of teaching opportunities for students across the board. among these opportunities is the utilization of speech recognition (SR) technology, also referred to as speech-to-text (STR), which presents a novel instructional approach by synchronizing captions and transcripts of both live and recorded speech (Bain et al., 2005). By employing speech recognition technology, real-time speech inputs are converted into text format, enabling speakers to communicate through a microphone while the speech is instantaneously

recognized and displayed as text on a whiteboard or computer screen. Throughout this process, a computer keyboard can be utilized to amend any words or phrases that were not recognized accurately or were initially misinterpreted (Wald & Bain, 2008).

Significant advancements have been made in the development of speech recognition products over the past decades, enabling their versatile usage across various domains (Shadiev, 2016). These products serve diverse purposes, including video captioning, voice-controlled computer operations, dictation, and hands-free written tasks facilitated by speech recognition (SR) applications. Some of these products cater to individual users, while others support multiple speakers. Popular examples of voice-to-text products include Caption MicTM, Nuance-Dragon Naturally SpeakingTM, Dragon Dictate for Mac, iCommunicatorTM, Video Remote interpreter, CaRT (communication access real-time captioning), and CPrint. Dragon Naturally Speaking TM has emerged as one of the most widely utilized and well-known speech recognition programs in the English language over the past two decades (Ranchal et al., 2013). additionally, iCommunicatorTM stands out as a multifunctional product capable of converting speech to text, sign language, or computer-generated voice.

The Turkish speech recognition program known as "Dikte" stands as the primary program developed and widely adopted in this context. it encompasses several functionalities, including the conversion of speech to text, text to speech, and the ability to control computer operations through voice commands and sound recording. The program necessitates the use of a sound card and microphone, with specific brands and models dependent on the speech recognition (SR) software employed. The microphone captures the user's speech, while the sound card converts it into a digital format that can be interpreted by the SR software (Wald, 2010). Within SR programs, user profiles are established, requiring users to complete a training exercise by vocalizing specific sentences and 46 designated words into the software. These profiles are then utilized to compare spoken words with the user's profile, allowing the software to determine the words uttered by the user (Ranchal et al., 2013). Moreover, SR software may employ a general user profile that incorporates the speeches of multiple individuals (depending on the specific SR software) and grammar rules as an alternative approach.

Within commercially developed speech recognition (SR) software, dictation with punctuation is the most employed system, as opposed to transcribing spontaneous speech, which exhibits distinct structural and grammatical differences from written prose (Ranchal et al., 2013). This preference arises partly due to the challenges associated with reading transcripts that lack punctuation or formatting, resulting in a continuous stream of text (Wald & Bain, 2008). Different SR programs

offer varying functionalities, capabilities, and user-friendly features when it comes to dictating or providing verbal comments to the computer. In general, most STR programs include editing via word/voice commands, such as:

• “Select,” “select next/previous”
• "Delete,” "Delete Next/Previous"
• . "Capitalize,” "Capitalize Next/Previous"
• "Lowercase,” "Lowercase Next/Previous"
• "Uppercase,” "Uppercase Next/Previous".

In terms of punctuation, voice commands include:

• "Put Quotes Around "
• "Put Parentheses Around "
• "Put Brackets Around "
• “Put Comma”
• “Put Dot” and more.

Voice search shortcuts include commands like "search Google for X" or "search Mac/PC for 'basketball techniques paper'". There are many more features, such as Proofreading (reading selected texts aloud to users), the MouseGrid function, which allows the cursor's placement (mouse click and movement) to be directed with voice/word commands and creating new voice commands to control computer applications or setting up voice-triggered works, such as opening/closing different applications, among others.

In the past decade, extensive research studies have shed light on the potential of speech recognition (SR) as a valuable tool for enhancing accessibility and comprehension in educational settings for students of all abilities (Hwang & Huang, 2013). Students facing learning and physical challenges such as cerebral palsy, apraxia, visual impairments, dyslexia, hearing impairment, and difficulties in reading, writing, and spelling have all benefited from the implementation of SR. additionally, several studies have examined the use of SR in inclusive classrooms for students without disabilities, reporting significant educational outcomes. For instance, Ryba et al. (2006) explored the effects of SR applications on both native and non-native English speakers attending university lectures. Following the lectures, SR transcripts were displayed on a whiteboard, accompanied by edited texts. Based on the feedback from 160 participants, SR was found to have the potential to serve as an instructional support mechanism. Non-native speakers noted that the SR texts aided their understanding of the lecture content and facilitated better comprehension of the instructors'

delivery. Native speakers, on the other hand, found the SR texts particularly useful for review purposes during exams or when completing homework assignments.

Similarly, Shadiev et al. (2013) conducted a study to examine the effectiveness of speech recognition (SR) for graduate students who were non-native English speakers. The SR transcriptions of the lectures were provided in real-time on a whiteboard, as well as after the lectures as textual representations. Most participants reported that the SR texts clarified the lecture content and served as well-organized lecture notes. However, to enhance the effectiveness of the SR texts, improvements in the accuracy rates of SR were identified as necessary, and several strategies for maximizing their utility were identified.

In another study by Shadiev et al. (2013), the application of SR was extended to graduate and undergraduate non-native English speakers, with a focus on assessing the perceived usefulness of SR texts for learning. The study also investigated the impact of SR on students' learning outcomes and compared participants' visual attention and learning behaviours, including learning style preferences and gender. Eye-tracking software (SMI IView X Red) was employed to detect participants' visual attention, allowing for an analysis of their attention distribution across different areas of interest, such as instructional videos, SR text, and lecture slides. Specific measures such as fixation count (the number of fixation points in a particular zone), fixation frequency (the number of fixation occurrences on a specific area of interest), and percentage of fixation duration (the proportion of total fixation duration spent on the SR text displayed on the whiteboard) were employed.

The study involved transcribing the speech of lecturers into text format using SR and displaying it on a whiteboard. The findings from twenty-one participants revealed a higher reliance on the SR texts compared to the instructors and lecture slides. Participants with lower English proficiency reported greater improvements in their learning performance compared to those with higher English proficiency. The SR texts were found to be beneficial for learning development regardless of participants' English levels, learning preferences, or gender differences. However, individual differences among students were identified, such as participants who had poor English listening skills but demonstrated excellent reading skills.

According to the participants' feedback, reading the speech recognition (SR) texts proved more beneficial in understanding the lecture content compared to solely relying on listening to the instructor, primarily due to the participants' limited English proficiency, which often resulted in

gaps in their comprehension. The SR texts were particularly helpful for participants in identifying words they were unfamiliar with in auditory form but could easily understand in written form (Shadiev et al., 2014).

In a study by Goddard et al. (2007), an SR system was implemented in primary school classrooms to enhance students' learning skills. each participant created a personalized user profile and underwent training with the SR system to improve the accuracy of transcribing their speech. Students received text versions of their spoken language and had the opportunity to listen to their audio recordings played back by the SR system. The findings revealed that SR proved to be an effective tool for improving pronunciation skills and served as a valuable training system for primary-level students. Immediate feedback and the ability to identify and correct errors were reported to significantly support language development. additionally, as students listened to their audio recordings, they were also required to edit any incorrect transcriptions in the SR texts after the class, which was identified as an effective approach to enhancing writing, listening, and editing skills.

2.5.3 The Application of Speech Recognition (SR) in Special Education

According to research findings, the predominant mode of information communication in classrooms remains audio-based, which presents challenges for students with various learning and physical disabilities, including cerebral palsy, apraxia, visual impairments, dyslexia, hearing impairment, and difficulties in reading, writing, and spelling. Particularly for those struggling with notetaking and comprehending the content, the integration of assistive technologies such as media-to-text recognition technologies, including speech-to-text (SR), text-to-speech, and handwriting-to-text, has been recognized as a potential solution in educational settings (Shadiev et al., 2013).

SR technology serves as a technological tool that converts speech input into synchronous text transcriptions, which can be viewed on a whiteboard or computer screen (Hwang et al., 2012). Verbatim transcriptions facilitated by SR have been found to contribute to the development of enhanced comprehension skills, particularly for individuals who encounter difficulties in simultaneous notetaking, processing information while listening and observing, or for those who have missed a class or lecture. For instance, students with physical or mental health conditions, as well as those with hearing or visual impairments, can benefit from the utilization of SR (Wald, 2008). Research suggests that one of the advantages of SR is its ability to recreate the classroom experience, allowing students to revisit and better understand the notes, effectively leading to a

second opportunity to comprehend the material (Wald, 2008).

Speech recognition (SR) technology plays a crucial role in enhancing the independence of individuals with disabilities, as it reduces their reliance on others for essential tasks such as writing, reading, and gathering information from the internet (Alapetite et al., 2009). By enabling users to control and navigate computers through their voices, SR empowers individuals with disabilities to actively engage in computer-related activities, thereby enhancing their overall skills, writing abilities, reading comprehension, and listening skills across all age groups. Particularly for individuals with physical disabilities like cerebral palsy, apraxia, visual impairments, spinal cord injuries, and repetitive stress injuries, who may experience pain and difficulty with typing, SR provides an alternative means of computer interaction that reduces physical demands and engages them cognitively in their work and daily lives (Wald, 2008; Shadiev, 2012).

In addition, speech recognition (SR) technology can alleviate the mechanical aspects of typing and handwriting, addressing the challenges associated with typing difficulties and inhibitions in expressing thoughts. Nisbet and Wilson (2002) conducted The Speech Recognition in Schools Project, focusing on how SR could provide additional support for students struggling with reading, writing, and spelling difficulties. The project involved 23 schools, encompassing a total of 32 students. Individual sessions were conducted with students, during which their speech was simultaneously converted into written text using SR. Pre- and post-testing measures were employed to assess the impact of SR usage.

The findings revealed that SR proved effective in offering practical writing assistance to students experiencing writing difficulties. Students reported increased independence in writing tasks and faster writing speed. Furthermore, when compared to the students' handwritten notes, SR-generated texts significantly outperformed in supporting students with reading difficulties. In terms of spelling outcomes, the recording of students' voices and the provision of immediate feedback were identified as beneficial in facilitating improved spelling skills.

2.6 Teachers’ Self-Efficacy in Digital Literacy

Self-efficacy theory is widely utilized in educational research, training, and skill development activities. It refers to an individual's belief in their capacity to successfully perform a specific behaviour or task (Eachus & Cassidy, 1999). According to Bandura (1997), self-efficacy is confidence in one's ability to plan and execute the necessary actions to achieve a desired goal.

These self-efficacy beliefs significantly influence behaviour, impacting factors such as the perseverance and resilience individuals demonstrate when faced with challenging tasks or setbacks. individuals with low self-efficacy are more likely to exhibit less persistence and may struggle to complete tasks. Therefore, the attainment of a keen sense of self-efficacy is deemed crucial, as it is equally important as possessing the requisite skills themselves.

According to studies, even if a person lacks a particular skill, they can still complete a task requiring that skill if they have an elevated level of self-efficacy in that skill. Additionally, malleable, self-efficacy beliefs can influence one's intellectual capacity. according to research on teacher efficacy, there is a positive relationship between that factor and students' motivation, success, and development of competencies (Marjolein & Helma, 2016). Through their planning, instructional strategies, and willingness to try out novel materials and methods of instruction, teachers' levels of self-efficacy also have an indirect impact on students (Megan & Anita, 2001).

One of the factors influencing teachers' professional success is their belief in their abilities. Teachers' professional achievements are determined by their belief in their professional competencies, their ability to apply these competencies effectively, and their ability to fulfil their duties (Ylmaz et al., 2004). The belief in teacher self-efficacy plays a crucial role in evaluating teachers' professional commitment and predicting the outcomes they can attain (Aslan & Kalkan, 2018). Teacher self-efficacy belief serves as a motivating factor that influences professional commitment, in-class behaviours, and the ability to persevere and demonstrate patience throughout the educational process. it serves as a significant source of support for the effectiveness of education and training endeavours (Klassen & Tze, 2014).

Teachers who exhibit higher levels of self-efficacy tend to provide self-drive and motivation in the teaching profession and impart the same to their students, whereas teachers with low self-efficacy may experience a decline in their abilities, which may directly affect their teaching behaviours (Kandemir, 2015). Teachers with low self-efficacy may be unable to use their knowledge and skills effectively in the education process, whereas teachers with high self-efficacy but lacking in knowledge and skills can effectively manage the education and training process. one of the indicators of a teacher's success is their ability to manage the educational process effectively. The teacher's success or failure in the educational process is related to the teacher's sense of self-efficacy (Kaçar & Beycioglu, 2017).

Teacher self-efficacy has emerged as a significant predictor influencing the way teachers shape their

instructional practices to enhance students' motivation to learn, making it a relevant construct in both educational contexts and other domains focusing on skill development (Erik et al., 2011). Perceived self-efficacy refers to an individual's subjective assessment of their capabilities to perform specific tasks with varying degrees of certainty (Barry & Bandura, 1995). Consequently, self-efficacy is typically measured through self-report scales completed by the participants themselves. Designing an accurate self-efficacy scale requires careful planning, where multiple statements (items) are formulated to assess individuals' beliefs about their skills and competencies related to the specific domain. Respondents are then asked to indicate their level of confidence in performing the described actions based on their existing knowledge and abilities, using a Likert scale. The statements in the self-efficacy scale are phrased positively and focus on actions rather than specific knowledge. For instance, when assessing an individual's ability to operate a computer, an appropriate self-efficacy statement might be "I could turn on a computer" instead of "I know how to turn on a computer."

2.6.1 Teacher Self-efficacy – Use of Technology.

Bandura (1997) further emphasized that self-efficacy is a context-specific trait, suggesting that the rapidly evolving landscape of technological tools necessitates a distinct form of self-efficacy among teachers for the effective pedagogical use of technology. He argued that teachers who possess high self-efficacy in utilizing technology are more inclined to integrate modern technologies into their instructional practices. Consequently, several researchers (Anderson & Maninger, 2007) have defined self-efficacy toward technology integration as teachers' confidence in their ability to use technology effectively. Compeau and Higgins (1995) defined computer self-efficacy as "an individual's judgment of their capability to use a computer" (p. 192).

Teachers with higher levels of self-efficacy in ICT or computers tend to use computers more frequently and experience lower levels of computer-related anxiety (Sam et al., 2005). The significance of self-efficacy in shaping the learning environment is evident, with some scholars attributing constructivist teacher beliefs explicitly to their perceptions of ICT self-efficacy (Krumsvik, 2014). Recent research investigating self-efficacy and iCT use in teaching supports Bandura's assertions and highlights that increased levels of computer self-efficacy can lead to greater confidence in effectively utilizing ICT as a teacher (Fanni et al., 2013). Hammond et al. (2011) explored the factors influencing teachers' adoption of ICT and found a correlation between lower levels of ICT self-efficacy and less frequent use of ICT in instructional practices. Moreover, Hatlevik (2017) identified a connection between self-efficacy in using digital tools and the

integration of ICT for teaching purposes. additionally, there is a relationship between the computer use of student teachers and their computer self-efficacy (So et al., 2012).

Self-efficacy levels are believed to be influenced by previous experiences, verbal persuasion, and anxiety levels (Bandura, 1993). one's perception of their technological proficiency serves as the foundation for computer self-efficacy. The degree of computer self-efficacy significantly impacts an individual's likelihood of using computers and their willingness to explore various computer-related technologies. Given the relevance of computer self-efficacy across professional domains, several scales have been developed to measure an individual's computer self-efficacy. However, these scales have faced criticism regarding limitations such as the validity of the questions in terms of their general applicability, the difficulty in comprehending the necessary level of detail in the questions, and the challenge of discerning whether the scales assess learning self-efficacy or computer self-efficacy (Cassidy & Eachus, 2002).

The field of technology operates under the assumption that usability is a crucial factor for acceptance. if teachers perceive a technology to be usable, they are more likely to embrace and adopt it. Researchers have developed the Technology acceptance Model (TAM) to examine the relationship between core technological and psychological variables and usage behaviour. according to TaM, users' cognitive responses to technology, specifically perceived usefulness, and perceived ease of use, influence their behavioural responses towards technology (Holden & Rada, 2011). Expanding on this model, Griffen (2006) explored the subjects' intention to implement technology by incorporating a probability dimension between the subjects and the integration of technology. The study revealed that the relationship between intention to use and actual technology use weakened over multiple training sessions, due to the complexity of the software employed (Griffen, 2006). Consequently, if subjects perceive technology as overly complex, their interest in using it diminishes, even with multiple training opportunities. To address this, teachers should be provided with meaningful activities and collaborative opportunities to enhance their understanding of available technologies and work through any challenges or difficulties (Griffen, 2006).

Krumsvik (2014) differentiates between two aspects of self-efficacy related to ICT usage: confidence in using ICT independently and confidence in using ICT for instructional purposes. Scherer and Siddiq (2015) further highlight that computer self-efficacy encompasses both basic and advanced operational and collaborative skills, as well as self-efficacy in utilizing computers for instructional purposes. While these constructs are highly correlated, they represent distinct dimensions. Hatlevik and Hatlevik (2018) propose that teachers' general perception of their own

ICT skills, known as general ICT self-efficacy, is a necessary but not sufficient determinant of their self-efficacy in using ICT for instructional purposes. This is logical since competence in a skill is a prerequisite for effectively integrating it into instruction. additionally, partner and Ottenbreit-Leftwich (2010) found that teachers' ICT self-efficacy is influenced by internal factors such as technological knowledge, pedagogical knowledge, and content knowledge. They highlight the importance of teachers' confidence in facilitating student learning through their acquired ICT knowledge and skills, emphasizing that knowledge and skills alone are insufficient to drive behavioural changes in teachers. Given the complexities of integrating ICT in teaching, this study aims to examine the impact of teachers' ICT self-efficacy as a determining factor in their ability to effectively integrate ICT into their instructional practices.

2.6.2 Teachers' Self-Efficacy – Attitude

Teachers' attitudes towards technology are crucial in the integration of technology into education. Jhurree (2005) emphasizes the significance of teachers having a positive attitude towards computer-based learning environments, as they play a pivotal role in influencing the teaching and learning processes within the classroom. among the numerous factors influencing teacher success, teacher self-efficacy has been identified as one of the most related variables.

Research dating back to 1986 has consistently shown that teacher self-efficacy predicts teachers' teaching philosophy, instructional practices, and even student achievement (Ashton & Webb, 1986). This perceived sense of self-efficacy, coupled with the daily stressors that teachers encounter, directly impacts their experience of burnout. Teacher burnout refers to emotional exhaustion, fatigue, and a diminished sense of personal achievement resulting from the day-to-day challenges teachers face. These stressors can include behaviour issues among students, conflicts with parents or colleagues, and the need to adapt to new organizational structures due to educational reforms (Skaalvik & Skaalvik, 2007).

Teachers who possess an intense sense of self-efficacy are more likely to cultivate a dynamic and student-centred learning environment. in this constructivist approach, students take ownership of their learning, resulting in greater student engagement and achievement (Swan, Wolf, & Cano, 2011). as students begin to recognize the relevance of their learning and experience success, their confidence grows, creating a positive cycle of achievement for both students and teachers.

2.7 Challenges Influencing the Application of Digital Literacy Among Teachers.

A variety of challenges influence the application of digital literacy to facilitate learning. Most of the challenges are likely to be shared by different demographics, regardless of age, education level and individual contexts. According to Dewi et al., (2021), the main challenges influencing what they call digital literacy competencies are technical skills, critical understanding, and communicative abilities. The most important of these is critical understanding, which has been identified as the most dominant. They define this as the ability to question what one learns from online sources.

The PISA report (OECD, 2010) emphasized the significance of both initial and in-service teacher training in providing teachers with the necessary digital competencies. According to Falloon (2020), teacher training is a major factor in determining teachers' use of digital literacy. Access to resources, training, and support are also key factors in digital technology use (Brantley-Dias & Ertmer, 2013). Mumtaz (2000) summarizes these factors as "access to resources, quality of software and hardware, ease of use, incentives to change, support and collegiality in their school, school and national policies, commitment to professional learning, and background in formal computer training" in his review of the literature. This study aims to examine the potential impact of the aforementioned factors on the promotion of digital literacy in schools in Kenya and the Czech Republic. Several barriers have been identified that hinder the effective use of technology in these educational contexts. These barriers include limited teaching experience with ICT, inadequate on-site support for teachers using technology, challenges in supervising students during computer use, the absence of specialized ICT teachers to instruct students in computer skills, limited access to computers, insufficient time for successful technology integration into the curriculum, and a lack of financial support (Bingimlas, 2009). Addressing these barriers and promoting the use of digital devices in schools is crucial for enhancing digital literacy among students in these settings.

Teachers are committed to ensuring that every student receives a quality education. To support this goal, the federal government implemented the No Child Left Behind (NCLB) policy, which holds teachers accountable for student success and school funding. Failure to meet proficiency standards set by the government can lead to the loss of federal funding and school autonomy. As a result, teachers are constantly seeking innovative approaches to engage historically low-achieving students and differentiate their lessons. In this pursuit of educational reform, integrating technology has emerged as a complex process with varying practices across schools (Tondeur et al., 2013). Teachers have turned to technology as a means of providing the necessary differentiation to reach their students effectively. When educators perceive technology as beneficial to their work, they are

more inclined to utilize it. Moreover, as teachers become more familiar with technology, they tend to use it more frequently. This increasing familiarity and proficiency in one technology may also lead to a greater willingness to experiment with other technologies (Tabata & Johnson, 2008). Embracing technology in the classroom holds the potential to enhance instructional practices and support differentiated learning for students.

The rationale behind this approach is rooted in the fact that contemporary students, often referred to as digital natives, possess a natural affinity for modern technology. Nevertheless, it is essential to recognize that the efficacy of technology hinges on the competence of its users. Several elements contribute to the effectiveness of a curriculum, and one pivotal factor is the educator's proficiency in leveraging the available resources (Carlson & Reidy, 2004). A teacher's adept utilization of technology in the classroom significantly influences the overall effectiveness of the curriculum.

Despite the growing reliance on technology in education, many teachers express a lack of confidence in effectively integrating technology into their classrooms (Buabeng-Andoh, 2012). To address this challenge, schools have allocated a sizeable portion of their budget towards technology initiatives and provided teachers with brief training sessions when recent technology is introduced. However, Schoepp (2005) proposes that professional development programs should be comprehensive and tailored to meet the diverse needs of all educators. Many teachers feel that the training they receive is insufficient to adequately prepare them for successful technology integration in their lesson plans. Recent research indicates that teachers perceive professional development as fragmented and unrelated to their classroom challenges (Liberman & Mace, 2010). Despite some exposure to professional development, most teachers still feel ill-equipped to effectively utilize the available technology. It is evident that teachers' own learning experiences influence the quality of their instructional practices, and current technology training falls short (Tondeur et al., 2013). Therefore, there is a need to redesign professional development programs to address these concerns and provide teachers with the support they require to use technology confidently and effectively in their classrooms.

According to research, the effective utilization of technology by teachers is associated with their pedagogical beliefs. Ertmer, Gopalakrishnan, and Ross (2000) found that teachers who are considered exemplary in integrating technology adopt a constructivist approach to its use in the classroom. This approach entails designing activities based on student interests, promoting collaborative group projects, emphasizing student comprehension of complex concepts rather than rote facts, and positioning the teacher as a participant in the learning process alongside the students

rather than as the sole authority. It is characterized by student-centred and student-directed learning, necessitating a shift in the teacher's perceived control over the classroom, which can be challenging for more traditional educators. Conversely, teachers who effectively integrate technology have demonstrated greater adaptability to this teaching style. The assumption is that technology use encourages teachers to modify their instructional practices toward more student-centred approaches (Ertmer et al., 2000, p. 7). Consequently, enhanced technology integration enhances a teacher's instructional direction and focus.

Teachers must be able to confidently navigate all three categories of technology within the classroom to have a greater sense of self-efficacy about technology. Several studies have been conducted to determine which variables have the greatest impact on teacher self-efficacy regarding technology. one such study discovered that teacher beliefs, computer proficiency, and teacher readiness all had a significant impact on the successful integration of technology (Inan & Lowther, 2010). In their study (2010), Ertmer and Ottenbreit-Leftwich support this finding, but they add that "teachers' mindsets must change to include the idea that teaching is ineffective without the appropriate use of information and communication technologies." all these elements must be reinforced through training that will allow teachers to develop their sense of self-efficacy.

The primary aim of teacher education programs is to equip prospective teachers with the necessary skills to effectively utilize technology in their classrooms. Typically, these programs mandate the completion of an introductory course on technology as a prerequisite for admission. However, it is important to note that this standalone course does not adequately reflect the level of proficiency required by teachers in integrating technology within diverse instructional contexts. Multiple studies have indicated that while a technology-focused course may assist students in acquiring fundamental computer skills, it does not sufficiently prepare teachers for the comprehensive use of technology in various instructional settings (Vannatta & Beyerbach, 2000). Some argue that the presence of a separate technology course implies that computers and technology are not an integral component of instruction (Tutty et al., 2005).

Teachers' initial self-efficacy toward technology tends to diminish within the first few years of teaching in a classroom, as observed by Lee and Lee (2014). To address this decline and prevent its negative consequences, school systems should provide adequate professional development opportunities and support for teachers. Neglecting this aspect can result in lower self-efficacy levels among teachers, which has been associated with teacher burnout. Zhao and Bryant (2006) conducted a study that revealed while technology integration training can be effective, it primarily

focuses on basic levels of integration and requires supplementary measures to promote higher levels of technology integration.

One potential approach for addressing the need for comprehensive technology training is collaborative apprenticeships, which follow a community of practice framework. Glazer et al. (2005) define collaborative apprenticeships as a professional development model that facilitates teacher learning within their professional teaching community during regular school hours. This model relies on interactions between peer teachers and teacher leaders, progressing through four distinct phases aimed at advancing peer teachers to become teacher leaders. Through shared planning sessions, this model enables teachers to learn from one another and address their respective needs. Effective implementation of this model necessitates allocating sufficient time to establish shared instructional and technology integration goals, which can be communicated and implemented during collaborative planning sessions.

Plair (2008) proposed a knowledge-brokering approach for mentoring teachers, which involves designating a technology knowledge broker within schools. This individual would be specifically trained to provide support and guidance to teachers regarding technology integration. Their responsibilities would include staying updated on current technology information, designing and refining technology-based experiences, assisting teachers in incorporating technology into their classrooms, offering on-the-spot problem-solving assistance, and coordinating technology-focused learning opportunities for teachers (Plair, 2008). However, a potential limitation of this model is that it relies on a single knowledge broker, making it challenging for one person to meet the diverse needs of a large faculty and staff.

Lin et al. (2012) have identified various external factors that influence the effective integration of ICT in schools. These factors include the availability of technology, accessibility to ICT equipment, time allocated for instructional planning, technical and administrative support, alignment with the school curriculum, school climate and culture, faculty teaching workload and management practices, as well as the pressure to prepare students for national entrance exams. additionally, the perception and vision of school leaders are crucial in determining the success of ICT integration. The school culture is also recognized as a significant factor in the implementation of ICT, as it influences how teachers align their beliefs with the use of ICT. it serves as a moderator of teachers' actions, beliefs, and attitudes towards ICT use (Chai et al., 2009). Furthermore, cultural differences have been observed in the study conducted by Kundu (2018b), where Indian teachers reported a higher sense of authority compared to Western teachers, which negatively affected their utilization

of educational technology.

Teachers' internal factors play a significant role in the integration of ICT in education. These factors encompass teachers' beliefs, understanding of ICT use, attitudes towards technology integration, perceptions, motivation, self-confidence, knowledge, readiness, and self-efficacy in utilizing technology effectively (Lin et al., 2012). internal challenges related to ICT integration include student mobility, special needs, and anxiety, as highlighted by Frederick et al. (2006). Recognizing the complex nature of ICT integration and its impact on various stakeholders, Kundu and Bej (2020) proposed the 3e model for effective integration. This model emphasizes the interplay of three factors - teachers, students, and school administration - in influencing the successful integration of ICT.

The utilization of ICT in education has been a subject of extensive discussion among researchers and educators for over three decades (Lowher, Strahl, Inan, & Ross, 2008). Numerous studies have examined effective strategies and the availability of resources to support the integration of ICT in educational settings. The primary goal of these studies is to promote the use of ICT to address the challenges faced by administrations, schools, and teachers in the educational process (Petko, 2012). Barriers to ICT implementation refer to specific or general issues that hinder individuals in the field of education from fully embracing ICT opportunities (Gillespie, 2006). identifying these barriers is crucial to intervene and overcome them effectively (Nikolopoulou & Gialamas, 2013).

Numerous research studies have explored the process of integrating ICT into education and have identified various barriers to its successful implementation. These barriers encompass factors such as usability, flexibility, affordability, accessibility, infrastructure limitations, inadequate teacher training, low confidence and motivation, insufficient administrative support, educators' and administrators' attitudes toward ICT, lack of pedagogical adjustments and beliefs, and a mismatch with the curriculum (UNESCO, 2013). Considering these findings, UNESCO (2013) emphasizes the importance of careful planning and design in ICT implementation, highlighting the following themes to be considered:

Usability: A comprehensive educational ICT platform should encompass various functions, including user-friendly navigation to access relevant content, clear guidelines for content usage, compatibility with other assistive technology tools and devices, convenient log-on and menu options, tracking of student performance and records, and more. To enhance the effectiveness of ICT usage, teachers must find these components easy to use. Research indicates that if ICT is

perceived as difficult to use, educators are less likely to embrace it (Agyei & Voogt, 2011). Therefore, it is essential to carefully design ICT usability features, ensuring that they are intuitive and user-friendly (Georgina & Hosford, 2009).

Accessibility: To uphold the legal frameworks established in many countries, it is imperative to provide support for individuals in education, irrespective of their physical or mental abilities, using ICT. An essential aspect to consider is that ICT should offer inclusive information and be customized to cater to the diverse needs of all students, including those with special educational needs (SEN). This ensures that every student can fully participate in the educational process and benefit from the advantages offered by ICT, thus ensuring inclusivity and avoiding the exclusion of any students (Prestridge, 2012).

Flexibility: Designers initially implement ICT products, and subsequently, if necessary, modify them by incorporating the latest available alternatives to enhance their functionality. Consequently, technological devices within educational settings can undergo rapid changes. In this context, ICT platforms should possess the capability to integrate and adapt to new advanced technological resources as required. Teachers should have access to educational ICT materials from diverse ICT tools, enabling them to customize their instructional approaches based on their work environment and learning preferences. Moreover, curriculum and course designers should have the flexibility to easily customize core teaching materials to address students' specific needs, including the software or hardware necessary for running instructional applications (Nikolopoulou & Gialamas, 2013).

Affordability: ICT resources utilized by educational institutions and individuals serve diverse purposes, but their acquisition entails financial implications. It is worth noting that individuals with special educational needs often face economic constraints and may lack the means to procure essential ICT resources (Richardson, 2011). Consequently, educational institutions, healthcare services, and relevant organizations must take proactive measures to address the financial limitations faced by individuals with special needs. By mitigating the financial barriers, these institutions can ensure that those who may benefit the most from ICT are not excluded from accessing these resources (Richardson, 2011).

Cost: The financial implications of integrating ICT in education are a significant concern for educators and policymakers. The successful implementation of ICT in education necessitates the establishment of a cost-effective communication environment that is efficient and reliable. When catering to the needs of students with special educational needs (SEN), the continuous

advancements in high-tech devices and software programs may require additional funding. Moreover, the cost considerations may vary depending on the specific health needs of the students, as certain SEN students, including those with hearing impairments, autism, and learning disabilities, may require supplementary health support (UNESCO, 2013).

The presence of a well-established ICT infrastructure is crucial for ensuring equitable access to ICT resources in education. Over the past decade, significant developments in ICT have been observed in schools and among students (Saheli & Saheli, 2012). However, myriad studies have consistently identified barriers such as inadequate infrastructure, limited access to software and hardware, and poor connectivity, which impede the effective integration of ICT in education globally (Neyland, 2011).

Specifically, research conducted in Turkey has highlighted the persistent challenges related to ICT availability, particularly in special education schools (Aslan & Zhu, 2016). Furthermore, there is a pressing need for ICT software programs that are tailored to the unique needs of students with special educational needs (SEN) and individuals with hearing impairments (Unluer, 2011). Another barrier identified in the literature pertains to the lack of ICT resources specifically designed for teaching the Turkish language (TL). Sari (2013) emphasized the limited availability of ICT resources utilized in TL instruction within Turkish special education schools catering to students with hearing impairments. This scarcity of resources has been found to hurt the effective implementation of ICT in classrooms. Insufficiencies have been identified in terms of computer software programs and educational videos that visually address TL components such as grammar and syntax (Kubus, 2008).

The effective utilization of ICT in the classroom is contingent upon the digital competencies of teachers (Valiente, 2010). Teachers hold a pivotal role in translating ICT into meaningful teaching and learning experiences. Therefore, teachers must possess adequate ICT knowledge and skills. Existing literature highlights teachers' digital ICT competencies as a potential barrier to the integration of ICT in education (Oye et al., 2011). The literature identifies various obstacles arising from teachers' limited ICT knowledge and skills, encompassing areas such as software utilization, digital content design, computer application management, effective utilization of digital resources, and proficiency in operating technology-based teaching and learning tools (Kreijns et al., 2013).

In the context of Turkey, teachers' ICT competencies have been identified as a hindrance to the effective implementation of ICT in schools. Several studies have revealed that Turkish teachers lack

the necessary ICT knowledge and competencies required for utilizing ICT in teaching and learning (Isciturk, 2012). Girgin (2011) specifically investigated the ICT knowledge and skills of Turkish special education teachers, concluding that these deficiencies pose obstacles to the successful adoption of ICT in their instructional practices.

Teachers' and principals' perspectives and attitudes toward the use of ICT can have both facilitating and inhibiting effects. The attitudes held by teachers are a crucial determinant of the effectiveness of ICT implementation in education (Lan, 2012). Negative attitudes toward ICT among teachers may arise from the belief that ICT does not enhance learning or teaching, or from a preference for the traditional teaching model (Pierce & Ball, 2009). Moreover, challenges can arise in the process of ICT implementation for teachers and administrators, as the integration of new ICT teaching materials may not align with teachers' existing beliefs and practices (Berg, Benz, Lasley, & Raisch, 1998). Teachers may encounter conflicts when required to adhere to predetermined curricula and assessment materials that do not align with their pedagogical beliefs (Ertmer, Gopalakrishnan, & Ross, 2001). Similarly, Ravitz, Becker, and Wong (2000) have suggested that the diverse individual needs of students make it challenging for teachers to effectively balance multiple teaching objectives while incorporating new ICT into their instructional practices.

Insufficient teacher training has been consistently identified as a significant obstacle to the effective application of ICT in schools, as highlighted in assorted studies (Yapici & Hevedanli, 2012). These studies indicate that teacher training often lacks not only the technical knowledge necessary for ICT implementation but also the instructional and pedagogical understanding required for integrating ICT into teaching and learning processes (Sang et al., 2011). Professional development initiatives for teachers have proven to be instrumental in enhancing their ICT competencies, promoting collaboration among professionals and teachers, ensuring awareness of available technologies, and equipping teachers with the necessary skills to effectively employ ICT in authentic classroom contexts (Bacigalupo & Cachia, 2011). Consequently, it is crucial to provide teachers with ongoing training that addresses the ethical and pedagogical dimensions of ICT, considering the rapid evolution of technology (Akbulut et al., 2011).

The influence of educational professionals' vision and leadership on technology integration in teaching and learning has been recognized, highlighting leadership as a facilitating factor in the effective implementation of ICT in education (Papaioannou & Charalambous, 2011). Conversely, inadequate administrative support has been identified as a barrier to the successful integration of ICT in schools (Salehi & Salehi, 2012). in addressing the challenges associated with ICT integration

in education, Chigona et al. (2010) emphasized the importance of school management policies and strategies that provide incentives for educators, enhance ICT management practices, and promote the implementation of computer laboratory activities for both teachers and students. These measures can contribute to creating an enabling environment for ICT integration in educational settings.

according to scholarly sources, teachers established pedagogical understandings of ICT can either facilitate or hinder its implementation in education (Kreijns et al., 2013). This understanding is described as either a 'collision' or a 'collusion,' both of which have implications for the utilization of ICT in educational settings (Prestridge, 2007). The appropriate use of ICT in education can support pedagogical interventions and enhance curriculum delivery, considering the advancements in information delivery facilitated by computers (Kreijns, acker, Vermeulen, & Buuren, 2013). To achieve this, it is crucial to provide training and support to educators, enabling them to effectively adapt ICT resources and infrastructures and apply ICT in their instructional practices. However, it is important to recognize that the pedagogical outcomes of ICT integration may not be immediately observable, as they are a long-term process that requires ongoing maintenance (Kreijns et al., 2013). Since pedagogical beliefs are shaped by years of knowledge and experience, they may exhibit resistance to change (Keys, 2007). This resistance has been documented in the literature, highlighting the challenges associated with transforming teachers' pedagogical understandings of ICT use and hindering the integration of ICT in educational contexts (Orlando, 2009). Similarly, research conducted among Turkish teachers revealed that deeply ingrained pedagogical beliefs act as a barrier to the integration of ICT in Turkish schools (Uluyol, 2013).

insufficient support from the Ministry of National education has been identified as a significant obstacle in Turkish schools, according to several studies (Aydin & Gürol, 2016; Cakir & Yildirim, 2013; Cakiroglu, 2015). There has been a lack of ICT support provided by the ministry, with concerns raised regarding the inadequate infrastructure in special education schools (Sari, 2013). although the Ministry of National education introduced computers and smart boards in all special education schools through the "FATIH" national project between 2012 and 2015, the availability of materials specifically designed for students with hearing impairments has been insufficient (Karal, 2015). Furthermore, the ministry's provision of digital materials accompanied by visuals and sign language videos has been lacking, as some studies have revealed that special education teachers in Turkish schools have never received such resources (Goktas, Yildirim, & Yildirim, 2009; Sari, 2013).

Sari (2013) proposed that Turkish special education teachers resort to outsourcing ICT educational

tools due to a lack of material support. Schools utilize private companies and online resources to provide ICT support for teaching and learning. Powell (2015) demonstrated that teachers find outsourcing beneficial as it offers a variety of learning channels and materials for students. Similarly, principals perceive outsourcing as advantageous for teachers and students, as it addresses multiple academic aspects of education such as reading, writing, speaking, and listening (Powell, 2015).

On the other hand, there are potential risks associated with outsourcing ICT. Ball and Youdell (2007) argued that private companies prioritize profit and may shape educational practices, accordingly, focusing on their financial gains. These companies often reproduce related products each year with additional features, creating a sense of pressure for customers to stay updated with the latest developments in ICT (Ball & Youdell, 2007). Burch (2009) further emphasized the profit-driven nature of private-sector ICT developers, stating that they prioritize their commercial interests. This mindset may overshadow addressing students' educational needs (Burch, 2009). Supporting this perspective, Petrie et al. (2014) hypothesized that iCT producers may lack expertise or content knowledge regarding students' educational needs.

2.7.1 ICT Infrastructure in Schools

Insufficient ICT resources pose a significant obstacle to the effective utilization of ICTs in school teaching and learning, especially in developing countries like Kenya. The lack of accessible and available ICT resources hampers the integration of ICT in schools, impeding the realization of its economic and developmental potential. In Kenya, the presence of ICT equipment in schools remains alarmingly low, limiting opportunities for collaboration between learners and teachers through tools like email (Makokha & Mutisya, 2016). Moreover, internet access is severely restricted, with limited usage confined to administrative purposes. The research findings indicate that 40% of schools surveyed possess fewer than ten computers, rendering them insufficient for effective teaching and learning. Additionally, over 20% of schools have fewer than five computers, primarily utilizing them for administrative functions (Makokha & Mutisya, 2016).

Certain special schools may be ineligible to receive ICT resources, even through donation programs, due to their lack of access to essential infrastructure such as electricity. The selection criteria for placing computers and ICT equipment in schools typically consider factors such as security, power availability, and the presence of technologically proficient teachers (Rodrguez et al., 2019). In some cases, schools without electricity connections resort to using generators to power

computers, which is inconvenient as these energy sources are often used at night (Gayapersad et al., 2019). Consequently, only a limited number of teachers can utilize technology, resulting in low levels of ICT usage. To address this issue, an initiative has been implemented to enhance teachers' computer access and utilization. Before implementing ICT resources in educational settings, it is crucial to establish a well-founded justification. As computer equipment becomes increasingly accessible, teachers should prioritize their primary role as educators rather than becoming overly focused on the technology itself. Teachers need to expand their perspectives and recognize that advancements in computer technology provide opportunities for enhanced teaching and learning experiences (Kashorda & Waema, 2014).

For the successful implementation of ICT policies in education, it is crucial to have adequate infrastructure and facilities in place. Liang et al. (2005), in their study spanning six years of analyzing digital classroom environments, emphasize the necessity of basic facilities for integrating ICT. They propose that to effectively utilize technology in education, classrooms should be equipped with devices for both students and teachers, shared display projectors, network connectivity, and other necessary installations. This argument is further supported by Mingaine (2013), who asserts that facilities such as power supply, computer devices, software, and connectivity are essential for the effective integration of ICT.

Additionally, Langat (2015) conducted a study examining the challenges faced in implementing ICT in Kenyan primary schools and identified infrastructure and ICT equipment shortages as significant obstacles. The study, which involved 40 primary schools and 450 teachers, revealed that 94% of the schools lacked ICT equipment, all schools faced classroom shortages, and only two private schools had operational computer laboratories. Furthermore, other studies have also indicated inadequate or limited academic utilization of computers in Kenyan primary schools, along with a lack of digital customization in classrooms (Muinde & Mbataru, 2019).

Pelgrum (2001) defines ICT infrastructure in schools as encompassing the availability of equipment, software, Internet access, and other similar resources. Vanderlinde and van Braak (2010) further elaborate that ICT infrastructure pertains to the perceived availability and suitability of ICT tools provided in the school, including hardware, software, and peripheral equipment. Anderson and Van Weert (2002) emphasize that resources and facilities within schools are designed and implemented to support the ongoing transformation and development of various learning approaches. However, Krysa (1998) points out that outdated hardware and software impose limitations on the use of computers in instruction, hindering teachers from effectively integrating

technology. Conversely, Shiue (2007) suggests that when teachers possess the necessary hardware and software resources, they feel more empowered to incorporate technology into their instructional practices. It is important to note that resource scarcity poses a significant challenge for educational institutions that serve students with disabilities, as highlighted by Denglerová et al. (2022).

Cowie and Jones (2005) highlight that the provided ICT infrastructure enables teachers to access the school network, the internet, and various laptop accessories such as printers, digital cameras, data projectors, large TV screens, scanners, and video cameras. Moses et al. (2012) further assert that well-maintained ICT infrastructures offer educators increased opportunities to utilize instructional technology. Numerous studies have demonstrated that ICT infrastructure is a significant factor influencing teachers' capacity to integrate technology into pedagogy (Shiue, 2007). Within the realm of ICT infrastructure, two broad categories can be identified: technical support and management support. Technical support pertains to personnel possessing specialized skills who can assist and guide educators in incorporating technology into their instructional practices (Resta, 2002).

Dexter et. al. (2002) define technical support as encompassing the provision of access, operation, and troubleshooting assistance for hardware, software, and network resources. Frost and Sullivan (2006) emphasize that technical support includes support services provided by ICT facilities vendors as well as internal helpdesks established by the education ministry. The presence of technical support has been shown to have a positive impact on educators' personal use of ICT (Moses et al., 2008), as well as their integration of ICT into teaching and learning practices (Dexter et al., 2002). Therefore, it is crucial to incorporate guidance, support, and services as integral components of technology applications (Moses et al., 2012). Resta (2002) further underscores the importance of technical support throughout the curriculum when integrating ICT, as a lack thereof can create challenges and result in diminished support for curriculum implementation in addressing the identified barriers.

Administrative support, as stated by Baylor and Ritchie (2002), is the presence of encouraging ICT using role models such as the principal. According to Afshari et al. (2008), to provide technology leadership in administrative, instructional, and learning functions, these principals must become proficient in the use of ICT. Principals' encouragement and support motivate teachers to incorporate ICT into their classroom instruction (Aliet al., 2009). As a result, the presence of administrative support is critical in encouraging teachers to use ICTs to deliver instruction (Moses et al., 2008). Administrators who support the use of technology not only in words but also in action, according to

Baylor and Ritchie (2002), lead to acceptance of technology as a culture, and they concluded that if administrators were to cultivate a technology culture, they would need to figuratively "roll up their sleeves and join in" rather than sitting on the sidelines (p. 412). Thus, the success of effective ICT integration into teaching-learning practices is dependent on the school administration's support (Ali et al., 2009). In their study, Moses et al. (2012) recommend that school authorities and the relevant ministry pay more attention and place more emphasis on both technical and administrative support to ensure that teachers use ICTs in an encouraging environment.

2.7.2 Teacher Training on the Use of ICT in Education

As educational institutions increasingly rely on technology for communication and personalized instruction, the need for effective training models to support teachers in creating and implementing relevant lessons becomes more pronounced. One study conducted by Kopcha (2010) explored programs that utilized technology-savvy students as mentors for education students. While such programs offer advantages, such as mentors who possess a deep understanding of modern technology complexities, they face certain barriers to success. Challenges may arise from the differing goals and communication difficulties between technology and education majors. Other approaches involve training teachers to become technology experts who can then assist and train their fellow staff members in technology integration. However, this model requires individuals to assume multiple roles for diverse individuals.

Promising models that address concerns about teachers' inefficiency in technology use include teacher mentoring and collaborative planning. These models foster improved communication in terms of shared vision, support, and mutual benefits among participants (Tondeur et al., 2013). Both models incorporate strategies such as faculty modelling and computer skills instruction, which have demonstrated success in enhancing teachers' attitudes and abilities to integrate technology (Koh & Divaharan, 2011). According to UNESCO (2012), ICT in education has the potential to provide learners with opportunities to develop 21st-century skills, but this is contingent upon teachers' digital literacy. However, despite the formulation of policies and financial investments in ICT in education, studies focusing on teacher capacity in Kenyan primary schools indicate that technology integration in classrooms remains low (Piper et al., 2015). For instance, Langat (2015) conducted a study on barriers to ICT implementation in Kenyan primary schools and found that a sizeable number of teachers lacked computer literacy skills. Although these teachers acknowledged the importance of technology in education, they attributed the lack of effective planning by the government in providing them with in-service training on the use of technology in teaching and

learning.

In a study conducted by Abobo (2018), it was found that a huge portion of teachers surveyed were unable to effectively integrate technology into their teaching of Kiswahili. Similarly, Omolo et al. (2017) discovered that student-teachers were able to practice using technology in the classroom to teach Kiswahili after receiving guidance from their tutors. These studies suggest that teachers are willing to utilize technology in their classrooms after receiving proper training. However, in cases where teachers did receive training, it often focused only on basic computer literacy skills, such as using programs like Microsoft Office and Excel, which may not adequately prepare them for integrating technology into teaching and learning (Mwangi & Khatete, 2017). Wambiri and Ndani (2016) analyzed documents on primary teacher training in Kenya and found a gap in the pedagogical use of ICT. Additionally, Muinde and Mbataru (2019) discovered that although 85% of teachers in Machakos County had received ICT training from the Ministry of Education, a massive portion of them (62.3%) perceived the training as ineffective for teaching and learning. These findings support the observation made by Majumdar (2005) that many teachers who received ICT training through professional development programs lack the confidence and independence required to effectively integrate technology in their teaching due to the limited focus on computer applications in the training, often due to time constraints.

Omito et al. (2019) also conducted a study in Homa Bay County to assess teachers' computer skills in public primary schools. They collected data from 362 teachers and 85 principals using a cross-sectional survey design. The findings indicated that the number of teachers trained by the government was low, which Omito et al. (2019) argued was due to the trained teachers' responsibility to train their colleagues. Ngeno et al. (2020) discovered in the Ainamoi sub-county that teacher PD training did not include all teachers. This study by Ngeno et al. (2020) is related to research by Sharples and Moldeus (2014), which sought to establish teachers' perceptions of technology readiness in public primary schools. The mixed-method case study focused on multiple sites in Kenya, including Nairobi, Nakuru, Mandera, and Turkana, to compare integration in both urban and rural areas. According to their findings, only 8% of teachers felt adequately prepared to use technology in their day-to-day teaching, despite 78% of respondents believing computers were simple to use. The study concluded that the disparity between perceived ease of use and actual use in classrooms was caused by inadequate ICT integration training.

2.7.3 ICT Accessibility and Usage by People with Special Education Needs

According to Passey et al. (2018), the introduction of ICT resources in developed countries has led to the redesigning of educational systems and a shift from students being passive consumers to active creators. However, this transformation comes with its challenges, including the need to redefine the roles of teachers and to scale up educational innovations. Developed countries such as Japan, the United Kingdom, France, and Germany have acknowledged the potential of ICT resources in facilitating long-term changes in teaching, learning, and assessment practices (Enrique, 2018). This shift towards ICT integration will enhance student learning outcomes and better prepare young individuals for life, education, and work in contemporary globalized societies (Akkari & Maleq, 2019).

The utilization of ICT resources in addressing the needs of individuals with disabilities is a significant endeavour that enables education systems worldwide to embrace inclusivity (Hersh et al., 2020). Developed countries like China, Germany, the United States, and Japan have made efforts to incorporate individuals with disabilities at all educational levels (Cha et al., 2020). The implementation of ICT strategies is aimed at enhancing education through continuous application and improvement. Furthermore, recent educational reforms have emphasized the pivotal role of ICTs in transforming education systems, equipping learners with the necessary knowledge and skills to adapt to the challenges presented by rapid global changes (Barakabitze et al., 2019).

In the context of Africa, the integration of ICT assets in education is still in its initial stages, posing a risk for many countries to lag in technological development (Lloyd, 2020). Developing countries in Sub-Saharan Africa, including Uganda, Ghana, Liberia, Kenya, Zambia, and Sudan, have limited the adoption and utilization of ICT in education, despite having established complex ICT regulations in the education sector. These policies often prioritize financial gains in non-educational contexts rather than addressing the specific needs of the education sector (Achimugu et al., 2010).

Kenya, for instance, implemented its ICT policy in 2006 (CA, 2006), aiming to create a prosperous ICT-based society and positioning ICT as a central element in national development (Kashorda & Waema, 2014). The policy seeks to encourage the use of ICT resources and promote the growth of e-learning at all levels of education to enhance teaching and learning (Pavel, Fruth, & Neacsu, 2015). However, the policy lacks relevant data and provisions specifically addressing the use of ICT resources in teaching and learning within special schools. Consequently, the policy's provision of ICT resources has not adequately considered the unique needs of special schools.

According to Kenya's Vision 2030, the provision of ICT access in schools is expected to enhance the quality and productivity of education (MOEST, 2003). However, there is a lack of comprehensive assessment regarding the state of ICT resources in Kenyan public primary and special schools, with existing reports primarily coming from non-governmental organizations (NGOs). The implementation of the Digital Literacy Program (DLP) by the Kenyan government and the adoption of the Competency-Based Curriculum (CBC), which emphasizes ICT as a core competency, highlight the need for a thorough assessment of ICT resources in these schools to support policy and program implementation efforts. The availability of appropriate ICT resources is crucial not only for enhancing access but also for ensuring the quality and relevance of education for learners with disabilities and special educational needs.

The preliminary stages of developing a new system are crucial for its success (Mott & Leeming, 2013). Insufficient analysis and understanding of the program at the beginning can lead to overlooked aspects that are essential for the effective implementation of ICT in inclusive classrooms. Consequently, educators may be wrongly perceived as resistant to progress (Al-Sulaimani, 2010). Similar challenges in implementing ICT in inclusive schools have been found in several studies (Simelane, 2013; Tonui, Kerich, & Koross, 2016; Muriithi, 2017). These challenges can be both inherent and external (Bhebhe & Maphosa, 2019; Simelane, 2013). Bhebhe and Maphosa (2019), Mndzebele (2013), and UNESCO (2015) also mentioned the following findings and challenges for effective ICT implementation in Southern African countries, namely: i) a lack of ICT training and limited knowledge on the part of teachers; ii) teachers' attitudes toward ICT; iii) a lack of support for ICT-, and iv) a shortage of learning resources, clearly outlined curriculum.

There is no implementation plan for ICT in Eswatini (Isaacs, 2007). The Ministry of Education developed ICT policies, and schools were then encouraged to use ICT in teaching and learning. However, Mndzebele (2013) stated that there was still no institution in Eswatini that offered a degree program for teachers to become ICT instructors. One of the major impediments to effective ICT implementation in Eswatini's inclusive primary schools was perceived to be teacher training. The challenges of ICT implementation in inclusive schools may vary by country due to economic status, beliefs, culture, and background. According to Mndzebele (2013), Eswatini's ICT has failed due to inadequate planning, a lack of funding, and insufficient professional development initiatives. According to Madzima et al. (2013), ICT implementation in Eswatini primary schools continues to face numerous challenges, including limited availability of infrastructure and supporting elements, economic realities related to ICT use, insufficient training and teacher workload, a lack of technical support to sustain ICT availability, and the absence of an ICT curriculum due to an inadequate

regulatory framework.

Several studies on the factors influencing ICT implementation in inclusive classrooms have been conducted. Shiboko (2015) conducted research in Kenya on "teachers as factors influencing the use of ICT in English teaching." Mustafina (2016) conducted research on 'teachers' attitudes toward the use of technologies,' with a focus on teachers' attitudes. Eswatini, Madzima, et al. (2013) studied ICT education in secondary schools, whereas Simelane (2013) studied ICT integration in Science and Mathematics, focusing on teachers' ICT use in these subjects. Using a qualitative approach, this study investigated teachers' attitudes, the types of ICT tools used in schools, teachers' proficiency levels, and the challenges teachers face when implementing ICT in inclusive schools. There may be several factors that influence teachers' attitudes towards ICT such as culture, background, socio-economic status, and the environment and these were examined in this study.

The emergence of a knowledge-based economy has intensified global competition across various sectors, leading governments worldwide to prioritize access to high-quality education (UNESCO, 2013). In this context, ICT in education is seen to enhance educational access, particularly for rural populations, and to make teaching and learning more engaging. Several studies have supported the use of ICT in education, highlighting its potential to facilitate the learning process by helping students comprehend abstract concepts (Kozma, 1991). On the other hand, some argue that the benefits of ICT in education are limited since it primarily relies on the teacher's pedagogical skills and is merely a delivery mechanism (Clarke, 1983). Despite ongoing debates, policymakers have continued to lay the foundation for the utilization of ICT, aiming to leverage its perceived advantages.

Despite the limited empirical evidence on the outcomes of ICT investments in schools, there has been an increase in such investments even in developing countries (Piper et al., 2015). In Sub-Saharan Africa, countries like South Africa, Kenya, and Mauritius are recognized as innovation hubs, highlighting the potential for technology and its application in education in these regions (World Intellectual Property Organization, 2019). In Kenya, policymakers perceive ICT in education as a catalyst for knowledge acquisition, innovation, and skill development to address challenges in the education system (Republic of Kenya, 2019). As part of the country's development blueprint, Kenya's Vision 2030, the education curriculum has been revised to a competency-based curriculum (CBC). The aim of this reform, guided by the Kenya Institute of Curriculum Development (KICD), is to provide learners with world-class standards and skills, including digital literacy, necessary for success in the twenty-first century (KICD, 2017). The integration of ICT in

the curriculum is now emphasized across all subjects, representing a shift from the previous system where ICT integration was limited to secondary schools as an elective subject.

Specifically in the year 2020, education systems all over the world were confronted with the COVID-19 pandemic. Most governments were forced to close schools and limit public gatherings to stem the spread of the deadly respiratory disease. In Kenya, UNICEF estimated that COVID-19 had kept close to 20 million students from attending school (Brown & Otieno, 2020). As a result, to determine whether alternative methods of learning, such as e-learning, would be successful, this study focused on how teachers and schools were prepared for technology integration before the crisis. The research looked at the availability of ICT facilities in public primary schools, teachers' ability to use technology in teaching and learning, and teachers' perceptions of the usefulness and ease of use of ICT. Because digital literacy is regarded as an important skill for dealing with 21st-century developments, the teacher is a critical player in the successful implementation of ICT and should be adequately prepared through training (Hwang et al., 2010).

Previous research has highlighted several challenges that have hindered the integration of technology in Kenyan schools. Karsenti et al. (2012), in a study involving multiple Kenyan schools, identified several factors that impeded the pedagogical integration of ICT. These factors included a lack of ICT devices, teachers perceiving ICT as time-consuming and burdensome, technophobia among older teachers, and teachers' inadequate expertise in ICT, among others. In response to these challenges, the Jubilee Government 2013 announced a plan to integrate ICT into education by providing laptop computers to all first-year students (Muinde & Mbataru, 2019). However, according to Wanzala and Nyamai (2018), as of July 2018, only 19,000 out of 23,951 public primary schools had received technology devices, and only 70,000 out of over 300,000 teachers had received training just months before the implementation of the competency-based curriculum (CBC).

A survey conducted by the Teachers Service Commission, which specifically targeted some schools and had 1200 respondents, also revealed that teachers in public institutions faced significant challenges when it came to using ICT in their classrooms. 84.2% of teachers who responded to the survey said they had issues with the use of technology in the classroom. According to the survey, the top professional skills gap affecting teacher service delivery is technology integration (Oduor, 2018; Wanzala & Nyamai, 2018).

According to May and Zhu (2009), the ICT accessibility needs of people with disabilities in terms

of technology and websites have not been met, and debates have occurred since the late 1990s between disabled people and government entities, educational institutions, and private sector web sites (Lopes, Gomes, & Carrico, 2010). Because of the long-standing lawsuits and complaints regarding the creation of accessible ICT for people with disabilities, many regulations and guidelines have been developed by government entities such as the World Wide Web Consortium (W3C). This document, first published in 1999 and updated annually, provides guidelines and recommendations on how to create ICT accessibility in technologies and websites to meet the needs of people with disabilities.

Abraham (2009) highlighted the issue of ignorance and intentional practices aimed at reducing expenditure on ICT accessibility for people with disabilities, which poses a significant challenge for technology and web developers. Financial constraints were identified as one of the barriers in Abraham's research. The study examined the period between 2000 and 2006, focusing on meeting the technological needs of people with disabilities, and found that technology professionals have been reluctant to design assistive technology in this context due to perceiving this market as less profitable. However, according to Abraham (2009), there has been an increase in awareness of ICT accessibility and technology production among technology professionals and the public since 2007. This change can be attributed to a range of factors such as sanctions, enforcement, demands and protests from people with disabilities, efforts by human rights organizations, societal support, and the inherent potential of technology itself. The author noted that today's rapid technological advancements have further incentivized professionals to create digital technologies that promote accessibility. Moreover, the growing professionalism in sectors like business, education, and health has fostered a competitive environment among companies, government entities, and individuals across various sectors, including health, military, and education. As a result, previously marginalized individuals with disabilities have benefited from increased ICT accessibility, reduced ignorance, and a diminished sense of exclusion in society (Krazit, 2009).

The rapid evolution of technology has resulted in the transformation of ICT materials into digital formats, leading to the widespread presence of ICT today (Newell, 2011). Communication through computers, phones, and the Internet has become a commonplace method of interaction and information acquisition. This digital world fosters a need for individuals, particularly in developed and affluent nations, to be well-versed in technological advancements, aiming to enhance information transfer, streamline communication processes, and develop innovative tools for various purposes (Mattern & Floerkemeier, 2010). Inevitably, individuals with disabilities also require accessible ICT tools to access information easily and establish effective communication channels

with others across the globe. Access to ICT enables these individuals to feel included in society and part of a world where people of diverse abilities interact and communicate with one another. Furthermore, ICT has the potential to help individuals with disabilities overcome social discrimination. Although the transformative impact of ICT on attitudes toward disability and societal responsiveness to the needs of individuals with disabilities is a long-term process, it holds significant potential for social change (Bohman, 2012).

ICT plays a vital role in empowering individuals with disabilities to actively participate in the digital world. Specifically, customized software and hardware solutions cater to their specific needs, enabling them to navigate and interact with digital content effectively (Samant, 2013). People with visual impairments can utilize text-to-speech and text-to-Braille tools, which convert written text into spoken words or Braille documents, respectively. Additionally, the inclusion of audio descriptions for videos and visual materials enhances accessibility and facilitates the retrieval of information. Likewise, individuals with dyslexia can leverage similar strategies that support the clear communication of information, ensuring inclusivity and equal opportunities for participation.

Throughout history, non-digital technologies have played a vital role in facilitating communication and information transmission for individuals with disabilities. These technologies include various forms of direct interaction, such as speech, conversations, and lectures, as well as analogue devices like televisions, radios, telephones, and written documents (Vanderheiden & Treviranus, 2011). People with disabilities have heavily relied on these devices for communication and accessing information (Bohman, 2012). However, the accessibility and adaptability of these devices have been limited in several ways, such as the absence of accessibility features in TV sounds, radio broadcasts, phone conversations, videos, and news. In the case of individuals with Deafness and Hearing Impairment (DHI), non-digital ICT devices included printed transcripts of TV shows, radio broadcasts, and news articles. Additionally, a text-to-voice relay service has been utilized, where written text is translated into voice by an intermediary person, enabling communication between individuals with hearing loss and both deaf and hearing individuals. Text messaging via phone has long been a primary mode of communication within the deaf community, and advancements in technology have now made visual live communication and video chat through sign language possible on more advanced smartphones.

The lack of transcripts for TV and radio programs, which are necessary for individuals with DHI, highlights the inflexibility and inconvenience of analog ICT technologies. Individuals with DHI heavily rely on the services of professional transcriptionists, which can be time-consuming and

financially burdensome. The demand for these services often exceeds the availability of professional transcriptionists. The use of Telecommunication Devices for the Deaf (TDD) services presents additional challenges, as these devices are not portable and require a fixed phone line. This limits the mobility of individuals with DHI, as they can only use TDD services at home or in specific locations equipped with TDD devices. Making phone calls from public locations becomes impossible without access to TDD services. To address these issues and enhance communication opportunities for individuals with DHI, ICT developers must prioritize the needs of this population and ensure that ICT devices and content are designed with accessibility in mind (Bohman, 2012; Samant, 2013).

According to research, teachers' beliefs, and attitudes about the use of technology significantly impact their acceptance and implementation of ICT in education (Wambiri & Ndani, 2016). Merely providing devices without addressing teachers' attitudes and beliefs may not lead to the desired outcomes. In a study assessing teachers' beliefs, attitudes, self-efficacy, computer competency, and age, Wambiri and Ndani (2016) found that younger teachers exhibited a more positive attitude toward technology. This could be attributed to the technology training received by younger teachers during their education. However, it is important to interpret the relationship between teachers' age and years of service cautiously when it comes to technology use in schools. Bebell et al. (2004) argue that if a multifaceted approach to measuring technology usage is employed, the age difference becomes insignificant in certain specific uses of technology. Therefore, age alone should not be the sole determining factor when considering teachers' technology integration capabilities.

In Vihiga County, Western Kenya, Buliva (2018) conducted a study to examine teachers' perceptions of the usefulness of ICT in schools. The study specifically investigated whether there were any significant differences between male and female teachers. A convenient sample of county teachers was utilized, and an independent samples t-test was employed to analyse the data. The results indicated that there was no statistically significant difference in the mean scores of male teachers. Therefore, the study concluded that there was no significant disparity in the perception of computer usefulness between male and female teachers in Vihiga County.

In a study examining the implementation of the laptops project in public primary schools, Muinde and Mbataru (2019) found that 68.5% of the sampled teachers had a positive perception of using laptops in their teaching and learning. However, the study also revealed that 39% of teachers felt that the allocated time for technology integration was inadequate, and a sizeable portion of their instructional time was spent on setting up the devices. This finding aligns with previous research

suggesting that teachers may resist using ICTs in their classrooms if they perceive them as requiring additional time and effort (Omwenga et al., 2004).

In a study examining the potential and prerequisites of effective tablet integration in rural Kenya, Heinrich et al. (2020) found that teachers often excluded students perceived to be slow learners during ICT integration. This finding was based on a mixed-method approach that included classroom observations, teacher interviews, student surveys, and focus groups. The study revealed that due to time constraints within a lesson, some teachers expressed their inability to provide support to students who were facing academic difficulties. To address this issue, the study recommends providing more professional development opportunities for teachers to enhance their pedagogical skills in accommodating all learners, including those with disabilities, in a technology-integrated classroom.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the framework and procedures applied to address the research questions. The chapter begins by outlining the research design, encompassing the overall approach and rationale behind the chosen methods. Subsequently, the study location and target population including participant selection and sample size determination are presented. The chapter also details the study pilot and data analysis techniques, highlighting the statistical tools, software, thematic analysis model and ethical considerations, are discussed. This chapter is concerned with the general scientific and ethical principles used in conducting this study.

3.2 Study Design

A research design, according to Migiro and Magangi (2011) is a systematic approach adopted by a researcher to address a research problem in a specific and scientific manner. In this study, the descriptive survey design was chosen to enable a comprehensive assessment of teachers' application of digital literacy and self-efficacy in the Czech Republic and Kenya. Descriptive study designs, as discussed by Klassen et al. (2012) and Kothari (2004), facilitate extensive data collection on a large population within a short period, allowing for the determination and reporting of the existing scenario. Therefore, the study aimed to provide a detailed description of the phenomenon as perceived by the participants, aligning with the principles of descriptive research (Gall, Gall & Borg, 2014).

The primary objective of this method was to describe the situation as it existed during the data collection period. It is important to note that in descriptive research designs, the researcher has no control over the variables (Kothari, 2004). However, the aim is to gain a deeper understanding of the variables under study, even without exerting control over them, as emphasized by De Vaus (2002). Given these considerations, the descriptive research design was deemed most appropriate for this study. In addition to a descriptive survey design, this study adopted a comparative research paradigm in its analytical approach to examining and comparing digital literacy in the two countries.

Adopting a comparative research paradigm in the study of digital literacy among teachers of

learners with disabilities in the Czech Republic and Kenya offers a valuable opportunity to gain a comprehensive understanding of the subject, identify best practices, promote cross-cultural perspectives, and foster collaboration (Meuleman et al., 2022; Wahlström et al., 2018). According to Wahlström et al. (2018), comparative policy research can be described as transnational because of its interest in how policies move within and across borders, including the interactions between various levels of policy and territorial areas. Thus, a comparative research paradigm was adopted in this study because of its potential to contribute to the advancement of the understanding of digital literacy and inclusive practices for learners with disabilities in both countries given their vast differences in economic status, and socio-cultural status.

3.3 Study Location

The was carried out in Kenya and the Czech Republic. Kenya is a country located in East Africa while the Czech Republic is in Central Europe. Kenya has five basic administrative units namely counties, sub-counties, constituencies, divisions/locations, and sub-locations while the Czech Republic has three administrative units namely regions (“*kraje”*), districts ("*okresy*") and municipalities. In this study, data was collected from all 47 counties in Kenya and all 14 regions of the Czech Republic to ensure country-level representation of data.

3.4 Target Population

A target population is a group of individuals that share similar attributes and are identified as the intended participants for the research and to which the researcher may generalize findings (De Vaus, 2002). The target population for the study was teachers of learners with disabilities in special primary schools in Kenya and the Czech Republic.

3.5 Sampling and Sampling Procedures

A sample refers to a subset of the target population which is scientifically drawn from the main population for a study and for making inferences about the population (Creswell, 2013). To increase the level of precision in estimating population parameters based on a sample study, the sampling frame should be unbiased and flexible (Kothari, 2004). The sample was designed to fulfil the two basic principles of sampling set by Bairagi and Munot (2019): the principle of statistical regularity which states that enough samples selected on a random basis from the target population of study possess the required features of the population; and the principle of inertia in large numbers which states that larger samples produce more accurate results.

The study applied a probabilistic sampling technique. Typically, defining a population and then randomly selecting a sample is out of reach for most researchers due to limited resources, especially where the geographical region of the study is wide, and direct contact with participants is required. Researchers compromise by selecting an accessible sample, describing it in detail, and then letting the consumers of the research decide on the generalizability of the results (Gall, Gall & Borg, 2014). To resolve this, the researcher used digital technology to provide national access to the data collection tool in both countries. This ensured that: results would be generalizable to the entire target population; data were collected from regions deemed insecure to travel to, for instance, some northern parts of Kenya; and resource demands for the study were minimized.

The researcher acquired a list of all special schools from the Ministry of Education in each country. Thereafter, heads of all institutions were contacted, and a link to the questionnaire was sent to them together with a request to randomly select two teachers to fill in the questionnaire. The researcher did not influence this selection process. Two teacher participants were targeted from each school. Gender sensitivity was encouraged to ensure heterogeneity of participants in line with Braun & Clarke (2013).

3.6 Data Collection Instruments

Data collection instruments are tools used to gather empirical data from the field (Kothari, 2004; Gall, Gall & Borg, 2007). Gall et. al. (2014) recommends tests, questionnaires, observation schedules, interview guides, and other measurement methods for data collection in descriptive research studies. In this study, questionnaires for teachers and observation schedules were used to collect data on how teachers apply digital competencies to facilitate learning, self-efficacy in digital literacy among teachers of learners with disabilities, factors that influence the application of digital competencies in a class by teachers of learners with disabilities and to explore how teachers of learners with disabilities overcame the challenges faced in the application of digital competencies.

A teacher questionnaire and observation checklist were developed in line with the research questions of the study. The questionnaire was in the form of semi-structured questions that were administered to teachers to provide both qualitative and quantitative data about themselves, and the subject of study. The questionnaire was created by the researcher and coded on an open-source digital data collection platform. Contact with participants was made via the heads of their institutions as described above after which they were expected to respond. Thereafter, the researcher carried out class observations in both countries. The observation tool was digitized and hosted in the same open-source data collection platform.

3.7 Pilot of the Study

A pilot is a small-scale maiden study carried out before the actual study to evaluate the feasibility of the intended project to improve its efficiency and performance (Wittes, & Brittain, 1990). The pilot was conducted in 8 special primary schools, 4 in each country (Kenya and the Czech Republic respectively). The link to the digitized questionnaire was sent to head teachers to share with teachers and encourage all teachers to participate voluntarily. A total of 35 teachers participated in the pilot study, 21 from Kenya and 14 from the Czech Republic. The findings from the pilot study report were used to improve the validity and reliability of the data collection instruments (See Table 3.1 for reliability statistics).

3.7.1 Reliability of Data Collection Instruments

Cronbach's alpha was used to establish the internal reliability of Likert scale items used to measure variables (*See Table 3.1*) such as the application of digital literacy to facilitate learning (α = 0.87-Kenya, α = 0.86-Czech Republic) and teachers' self-efficacy in digital literacy (α = 0.86-Kenya, α = 0.83-Czech Republic). Reliability tests were run for each country separately because the test items were translated and administered in different languages. As Bairagi and Munot (2019) contend, the validity of an instrument should be within the context of its use. As presented in Table 3.1, Cronbach's alpha was above the minimum threshold of 0.7 for satisfactory reliability. However, items with the lowest item-to-total correlation were dropped after the pilot and others were re-written for clarity. Consequently, two items were dropped from the scale measuring the application of digital literacy leaving only 9 for the main study (*See Table 3.2*). Similarly, one item was dropped from the scale measuring self-efficacy in digital literacy leaving only 15.

Table 3.1: Reliability Test Statistics – Pilot Study

	Kenya			Czech Republic		
Variable	Valid Cases	items	α	Valid Cases	items	α
Application of digital literacy	21	11	0.87	14	11	0.86
Self-efficacy in digital literacy	21	16	0.86	14	16	0.83

Table 3.*2* presents reliability statistics for the questionnaire used during the actual data collection for the study. The reliability measure was computed based on the combined sample from Kenya and the Czech Republic and only items with missing entries were dropped. The Cronbach's Alpha (α = 0.894, α = 0.851) for both scales were higher than the pilot study, suggesting better reliability.

Table 3.2: Reliability Test Statistics–- Main Study

	Valid Cases	Items	Cronbach's Alpha (α)
Application of digital Literacy	457	9	0.894
Self-Efficacy in Digital Literacy	438	15	0.851

3.7.2 Validity of data collection instruments

Validity is the degree to which results obtained from the analysis of the data represent the phenomenon under investigation (Gall, Gall, & Borg, 2014). Validity describes the degree or quality of an instrument to which an instrument accurately measures the construct it is supposed to measure. Poitras et al. (2019) contend that validity is important because it helps ensure that the findings of a study are accurate and trustworthy. The validity of the questionnaire used in this study was achieved through an in-depth literature review of the theoretical foundations and frameworks of measurement of each variable was conducted. By using this strategy, fifteen question items were developed by adopting the content and constructs proposed in the General Self-efficacy Scale (GSES) (Jerusalem & Schwarzer, 1995) and Digital Competence Framework for Educators (DigCompEdu). Similarly, measures of teacher training, knowledge, skills, and experiences were based on accepted principles and models.

3.8 Measurement of Study Variables

Application of digital literacy: This variable encompasses the utilization of digital tools, technologies, and skills by teachers to enhance the learning experience of learners with disabilities. Conceptualization of this variable as used in this study involves teachers' general approaches to integrating digital resources into their teaching processes to engage learners. The application of digital literacy to facilitate learning is a latent variable that was measured by using a set of 9 Likert scale items (*See Section A of the Questionnaire*). All the test items were stated positively and a 5-point scale of "Strongly Agree, Agree, Neither Agree or Disagree, Disagree and Strongly Disagree" was used. In this case, the scale was standardized from 1 to 5, with 1 representing "Strongly Disagree" and 5 representing "Strongly Agree".

Internal consistency and item-total correlation analysis were conducted based on the combined sample from both Kenya and Czech Republic to assess the quality and performance of each item (*See Appendix IV*). Results show that the corrected item-total correlation) the range between r = 0.51 and r = 0.62 showing while Cronbach's Alpha if item deleted (α) ranges between α = 0.830 and α = 0.841. This result shows that there were no redundant items in the scale used for measuring the application of digital literacy to facilitate learning. Individual scores were then calculated by

assigning numerical values to each response option such that “Strongly Disagree” was assigned a value of 1, “Disagree” a value of 2, “Neither agree nor disagree” a value of 3, “Agre” a value of 4, and “Strongly Agree” a value of 5. These values were summed across the Likert scale responses for each item to obtain individual raw scores (x). The raw scores (x) were then standardized by computing the z-scores such that:

$$z = \frac{x - \mu}{\sigma}$$

where μ is the mean of the score and σ is the standard deviation. The standard scores (z-scores) were then used in the analysis.

Self-efficacy in digital literacy: This refers to an individual teacher’s belief in their ability to effectively use digital technologies and navigate the digital landscape for teaching. Conceptualization of self-efficacy in digital literacy as a variable of the study was based on the DigCompEdu framework that spells out skills, knowledge, and capabilities to utilize digital tools, platforms, and resources for purposes of communication, information retrieval, content creation, problem-solving, and critical thinking in the digital landscape. In this study, self-efficacy in digital literacy is a latent variable that was measured by using a set of 15 Likert scale items (*See Section B of the Questionnaire*). All the test items were stated positively and a 5-point scale of “Strongly Agree, Agree, Neither Agree or Disagree, Disagree and Strongly Disagree” was used. In this case, the scale was standardized from 1 to 5, with 1 representing "Strongly Disagree” and 5 representing “Strongly Agree”.

Internal consistency and item-total correlation analysis were conducted based on the combined sample from both Kenya and Czech Republic to assess the quality and performance of each item (*See Appendix V*). Results show that the corrected item-total correlation) the range between r = 0.46 and r = 0.66 while Cronbach’s Alpha if item deleted (α) ranges between α = 0.884 and α = 0.893. This result shows that there were no redundant items in the scale used for measuring self-efficacy in digital literacy. Individual scores were then calculated by assigning numerical values to each response option such that “Strongly Disagree” was assigned a value of 1, “Disagree” a value of 2, “Neither agree nor disagree” a value of 3, “Agree” a value of 4, and "Strongly Agree” a value of 5. These values were summed across the Likert scale responses for each item to obtain individual raw scores (x). The raw scores (x) were then standardized by computing the z-scores such that:

$$z = \frac{x - \mu}{\sigma}$$

where μ is the mean of the score and σ is the standard deviation. The standard scores (z-scores) were then used in the analysis.

Challenges influencing the application of digital literacy: This variable was used to explain constraints to the application of digital literacy by teachers in Kenya and the Czech Republic. A set of fourteen (14) independent items were used with a 5-point Likert scale from which the respondent would rate their level of agreement. Since each item was independent of the other, Principal Component Analysis (PCA) used a dimensionality reduction technique to cluster uncorrelated factors that were used in the analysis. Before PCA was conducted, reverse coding was done by assigning numerical values in reverse order such that Strongly Agree was assigned 1 while Strongly Disagree was assigned 5. This was necessary because of the hypothesized negative correlation between these factors and the application of digital literacy to facilitate learning.

Teachers' ICT Skills: This variable describes the teacher's proficiency in utilizing different ICT resources in their teaching practices. It was measured through classroom observations and teachers were scored based on their basic computer skills and pedagogical integration, and communication. A higher score indicates a more skilled teacher while a lower score indicates a less skilled teacher.

Teachers' Academic Level: This variable describes the highest academic qualification completed by the teacher. It was measured using a multiple-choice question in which the teacher would indicate their highest academic qualification achieved such as Certificate Level, Diploma level, undergraduate level, master's, and PhD level and only one option could be selected.

Teaching Experience: This variable describes the duration (in years) the teacher has taught learners with disabilities by the date of data collection. Teachers were grouped into six homogenous clusters such as Under 5, 6-10 years, 11-15 years, 16-20 years, 21-25 years and above 25, only one option could be selected.

ICT infrastructure in School: This variable describes extrinsic aspects such as the availability of relevant hardware, software, and connectivity to power and internet within the school. It was measured by ascertaining the availability of basic resources using both questionnaires (*See Section B*) and observation checklist (*See Part III*). During data collection, the availability of the pre-

determined ICT infrastructure was assessed and scored as either present or absent in each of the surveyed schools. Schools were classified into three homogeneous categories based on resource profile. Schools that had a combination of hardware, software and connectivity were grouped and labelled as 'High-Tech,' schools with either one of these resources or none were grouped and labelled as 'Low-Tech' while the rest having any two were grouped and labelled as 'Moderate-Tech.'

3.9 Data Analysis

This study involved analysis of both quantitative and qualitative data collected using semi-structured teacher questionnaires as well as observation checklists. Bingham et al. (2019) contend that in educational policy research, the objective of linking specific practices to specific outcomes is important but not the only goal. However, this emphasis on causality can lead researchers and funders to favour quantitative methods, potentially overlooking the complexities of educational practices and outcomes. Incorporating qualitative research methods alongside quantitative approaches through mixed-methods research provides a more comprehensive understanding of the connections between practices and outcomes in educational policy research (Bingham et al., 2019). Quantitative data including numerical figures and Likert scale responses were analysed using statistical methods while qualitative data consisting of text responses were analysed using thematic methods described as follows.

3.9.1 Analysis of Quantitative Data

This section describes data preparation methods used to transform actual question items from data collection instruments into measurable research variables used for analysis. The section also describes statistical methods used to summarize the results of each research question. All numerical analysis and graphics were performed using the Statistical Package for Social Sciences version 25 (SPSS.V. 25.0).

a) Data Preparation

The main variables used in this study were teachers' application of digital literacy to facilitate learning (dubbed as '*Application of DL*'), teachers' self-efficacy in digital literacy (dubbed as '*Self-Efficacy in DL'*), challenges affecting the application of digital literacy (dubbed as '*DL Challenges on DL*') and teachers demographics (*Gender, Teaching Experience, Teacher's ICT Skills, and Teacher's Academic Level*). Whilst teachers' demographics were directly obtainable/observable, application of DL, Self-efficacy in DL and DL Challenges were inferred (latent variables) based on

a set of Likert scale questions as discussed in section 3.7 on measurement of study variables. In this regard, principal component analysis (PCA), a dimensionality reduction technique was used after confirming that each scale met basic PCA assumptions (Jolliffe & Cadima, 2016).

Using SPSS, PCA was performed by selecting 'Factor Analysis' function found under the 'Dimensionality Reduction' section. This was then followed by moving all the scale items in the 'Variables' section and new variables saved on the main spreadsheet while maintaining the default setting of eigenvalues greater than one ($\lambda>1$) and 25 as the maximum iterations for convergence. The results for the component extraction for each variable scale (*See Appendix VI*) shows. Based on this method, two PCAs accounting for 60.15% of total variance were extracted from the scale on the application of DL, three PCAs from self-efficacy in DL and three PCAs from DL challenges accounting for 56.7% and 53.95% of total variations.

The extraction PCA was based on factor loadings such that items with the highest factor in each component were clustered together (*See Appendix VII, Appendix IX, and Appendix XI*). Using the DigCompEdu framework and related digital literacy theories, each component was assigned the most suitable label. The two PCAs for the application of DL were labelled as 'Selection and use of digital resources' and 'Integration of digital technologies in teaching and assessment' (*See Appendix VIII*) as the main aspects of the measured construct. Similarly, Appendix X and Appendix II respectively show the labels assigned to PCAs in the subsequent variables. These new variables were then used in the statistical analysis, interpretation, and discussion of results.

b) Statistical Analysis

Descriptive analysis including percentages, proportions and mean/averages were used to present results in a univariate way (Kaliyadan & Kulkarni, 2019). Categorical variables such as gender were analysed by summarizing their counts and percentages, while numerical variables were analysed by summarizing their measures of central tendency such as means/averages and measured deviations such as standard deviation. Statistical results were presented in the form of tables and graphics including cross-tabulations, boxplots, and density distributions.

An Independent sample t-test was used to compare statistical differences in the means/averages of numerical variables between Kenya and the Czech Republic. The t-test was used with the assumption that the samples of participants from the two countries are independent of each other but the distribution of variable scores in each country is normally distributed and homogeneity of

variance. Chi-square (χ^2) test on the other hand was used to compare statistical differences in proportions of categorical variables between Kenya and the Czech Republic. Both the independent sample t-test and chi-square test were conducted at a 95% confidence level.

3.9.2 Analysis of Qualitative Data

Qualitative data collected in this study was in text form where study participants responded to closed-ended questions. This was a critical set of data relating to how teachers reported on how they overcome challenges they face in applying digital literacy to facilitate learning. Given the unstructured nature of qualitative responses, thematic analysis was used to synthesize the responses, classify, interpret, and discuss them within a context. Specifically, the six-stage thematic analysis model proposed by Braun and Clarke (2006) was applied. The six stages provided in the model are (i) familiarisation with data, (ii) initial code generation, (iii) searching for themes based on initial coding, (iv) review of themes, (v) theme definition and labelling and (vi) authoring a report of findings (Braun & Clarke, 2006; 2013). Whilst Morgan and Nica (2020) contend that thematic analysis is an iterative and recursive process that requires back and forth between the stages, this was not the case in this study given the smaller scale of qualitative data collected.

- ***Stage I, Familiarization with Data***: This stage involved reading and re-reading the responses provided by the teachers, especially on how they overcame challenges. This was conducted by reading randomly some responses and stopping at saturation point when similar responses are frequently observed. Saturation according to Ando et al. (2014) is a good point to claim familiarity with the content and gain an overall understanding of the dataset.

- ***Stage II, Initial code generatio***n: This stage involved identifying and labelling meaningful units of information or "code" using distinct colours. These highlights would cover an entire cell in Excel or specific words, phrases, or short sentences that capture similar and distinct challenges. This stage involved coding the entire dataset for both Kenya and the Czech Republic.

- ***Stage III, searching for themes based on initial codin***g: This stage involved locating potential patterns in responses provided. This was done by tracking recurring concepts that emerge from the codes highlighted in the second stage. At this stage, a comparative analysis was done to establish any connections in responses against individual demographics such as

country and academic level.

- ***Stage IV, Review of theme***s: This stage was primarily for refining the already identified themes. This was done by cross-checking each theme, considering how it fits with the coded data, and ensuring that each theme is coherent and distinct from others.

- ***Stage V, Theme definition and labellin***g: This stage involved ensuring clarity and conciseness of each theme. This involved changing the names of the entire theme to accurately represent the content and meaning of the data encompassed.

- ***Stage VI, drafting a report of finding***s: This stage involved exporting different thematic texts from the Excel spreadsheet into the Word document. Compilation and drafting of the analytical report on the research question involved presenting the identified themes with supporting evidence from the coded data and providing explanations and interpretations. Direct quotes from respondents as part of supporting evidence were accompanied by a pseudocode that shows the country (K- for Kenya, C-for Czech Republic), gender (M-for male, F-for Female) and three-digit ID (xxx). For instance, KM123 suggests a Male respondent from Kenya who is whose ID on the primary data is 123 while CF009 is a Female respondent from the Czech Republic whose ID is 009.

3.10 Ethical Considerations

This study was conducted in compliance with ethical standards in both Kenya and the Czech Republic ensuring responsible conduct of research. The proposal and dissertation were prepared under the supervision of the University professor and due processes stipulated Charles University was followed. Before data was collected in the Czech Republic, the proposal was reviewed by the Ethical Committee of the University and approved on 26th July 2022 (*See Appendix XIII*). In Kenya, a research permit was sought from the National Commission for Science, Technology, and Innovation (NACOSTI) and licence NACOSTI/P/22/22219 was granted on 6th December 2022 (*See Appendix XIV*). Data was collected in adherence to the General Data Protection Regulation (GDPR) as applied to the European Union (EU) countries as well as the Kenya Data Protection Act, 2019. Both these legal frameworks provide for privacy protection of study participants, informed consent, voluntary participation, and data protection. All these provisions were followed during data collection in both countries.

All personal identifiers were deleted from the collected data and replaced with pseudocodes to ensure data anonymity to the extent that no individual persons could be identified from the data. To ensure data safety, data was stored in encrypted file folders whose access is limited by a password and needs dual verification to open, hence preventing unauthorized data access. In addition, metadata to the primary data files was stored in separate file folders with similar security requirements of dual verification. The entire research was conducted in adherence to ethical considerations and the results were presented impartially in compliance with the accepted scientific and open science guidelines (Brabeck, 2021).

CHAPTER FOUR:
DATA ANALYSIS AND DISCUSSIONS

4.1 Introduction

The purpose of this study was to establish and compare the level of application of digital literacy among teachers in special elementary/primary schools in Kenya and Czech Republic, their self-efficacy in digital literacy, how they utilize digital literacy to facilitate learning, challenges which influence their application of digital literacy, as well as the strategies they put in place to overcome challenges faced in the process. A total of 456 respondents participated in the study, 329 from Kenya and 127 from the Czech Republic. The first section of the chapter presents the demographic information of the respondent while the subsequent sections present the findings in line with the study objectives.

4.2 Demographic Information

Demographic information presented in this study is teachers' gender, teaching experience, highest academic level and teacher ICT skill level in Kenya and the Czech Republic.

4.2.1 Distribution of Teachers' Gender

The study established the distribution of participants in terms of gender in the two countries. The findings were as presented in Table 4.1.

Table 4.1: Teachers' gender by Country

		Proportion by Country	
Gender	**Total (n=456)**	**Kenya (n = 329)**	**Czech Republic (n = 127)**
Male	160(35.0%)	149(45.2%)	11(8.7%)
Female	296(65.0%)	180(54.8%)	116(91.3%)

The findings in Table 4.1 show that there were more female teachers in the two countries (65%) compared to their male counterparts (35%). Desegregation of gender distribution per country reveals that a considerable proportion of teachers in the Czech Republic were female (91.3%) compared to Kenya at 54.8%, denoting a huge gender gap in the teaching profession, especially in special schools. The results of the study align with the findings of the OECD (2016), which

identified a significant feminization of the teaching workforce in the Czech Republic. Compared to the OECD and EU21 averages, the proportion of female teachers in the Czech Republic is notably higher. In primary schools, male teachers constitute only 3% of the teaching staff, while at secondary schools, they make up 26% of the teaching staff. Despite the huge gaps in the Czech Republic, related results apply to Kenya where more than half (54.8%) of teachers are female. This concurs with an earlier study by Kumar (2022) which reported that female teachers are in higher numbers than males at the primary education level. A comparison in terms of the gender of teachers in special schools in Kenya and Czech, therefore, shows that female teachers were more than male teachers in both countries.

4.2.2 Distribution of Teachers' Teaching Experience

The respondents were asked to indicate their teaching experience in years. The findings were as presented in Table 4.2.

Table 4.2: Teachers' teaching experience by Country

		Proportion by Country	
Experience (in year)	**Total (n = 456)**	**Kenya (n = 329)**	**Czech Republic (n = 127)**
Under 5	13(2.8%)	0(0.0%)	13(10.2%)
6-10	2(2.6%)	0(0.0%)	12(9.4%)
11-15	123(26.9%)	82(24.8%)	41(32.3%)
16-20	98(21.4%)	88(26.7%)	10(7.9%)
21-25	102(22.3%)	87(26.4%)	15(11.8%)
Above 25	109(23.9%)	73(22.1%)	36(28.3%)

The findings in Table 4.2 show that over 65% of teachers had above 15 years of teaching experience as follows; 23.9% had more than 25 years, 22.3% had between 21 and 25 years and 21.4% had between 16 and 20 years. In addition, 26.9% had between 11 and 15 years and those who had taught for between 6 and 10 years were 2.6% and under 5 years were only 2.8%. This result suggests that a significant majority of study participants were highly experienced teachers. Analysis of country proportions revealed that all teachers in Kenya had at least 10 years of teaching experience which is higher compared to the Czech Republic where teachers who had taught for at least 10 years were 80.4%. This shows that all teachers who had taught for 10 years or less were from one country, the Czech Republic. It was, however, noted that the proportion of teachers who had taught for above 25 years was higher in the Czech Republic compared to only 22.1% in Kenya.

4.2.3 Distribution of Teachers' Academic Qualification

The respondents were asked to indicate their highest academic qualification completed. The findings were as presented in Table 4.3. The academic levels are presented in ascending order starting with the lowest cadre of academic qualification and progressively to a PhD level.

Table 4.3: Teachers' academic qualification by country

		Proportion by Country	
Academic Levels	**Total**	**Kenya (n = 329)**	**Czech Republic (n = 127)**
Certificate	49(10.7%)	49(14.8%)	0(0.0%)
Diploma	113(24.9%)	113(34.5%)	0(0.0%)
Undergraduate	131(28.7%)	92(27.9%)	39(30.7%)
Masters	142(31.1%)	70(21.2%)	72(56.7%)
PhD	21(4.6%)	5(1.5%)	16(12.6%)

Results presented in Table 4.3 shows most of the teachers had completed a master's degree; however, this accounts for only 31.1% of all teachers and only 4.4% had completed their PhDs. It was found that 28.7% had completed their undergraduate, 24.9% had completed their diploma and 10.7% certificate level which is the lowest academic qualification at the time of data collection.
Analysis by country

4.2.4 Distribution of Teachers' ICT Skills

It may be recalled that teachers' ICT was a study variable based on classroom observations where teachers were scored based on their basic computer skills and pedagogical integration, and communication. It was observed that a significant majority of teachers in the Czech Republic were proficient in basic ICT skills compared to their counterparts in Kenya. Most teachers in the Czech Republic could operate a wider range of ICT tools with minimum help while in Kenya, most teachers needed support to make use of similar ICT resources. Overall, the ICT skills among teachers in the Czech Republic were higher compared to those in Kenya.

4.2.5 Distribution of ICT Infrastructure in Schools

ICT infrastructure in school is an extrinsic variable related to the availability of relevant hardware, software, and connectivity to power and internet within the school which certainly influences teachers' application of digital literacy. It was found that connectivity was the most prevalent infrastructure in schools in the Czech Republic. Comparatively, most schools in the Czech Republic had internet and power (electricity) connections compared to Kenya where both internet and power connectivity were scarce. In terms of hardware, most Kenyan schools lacked basics including

computers and portal devices such as laptops. In the Czech Republic, however, hardware was available, except in a few cases where they were fewer, hence not commensurate to the number of learners. Relevant software needed by learners with different disabilities was found to be scarce in Kenya and some schools in the Czech Republic.

4.3 Application of Digital Competency to Facilitate Learning

The first research question for this study was to examine how teachers apply digital literacy to facilitate learning in special primary schools in Kenya and the Czech Republic. To address this question, two aspects were studied; the first aspect was teachers' self-reporting on the set of 9 Likert scale questions on how they leverage various aspects of digital literacy to facilitate learning. The second aspect was teachers self-reporting on how they use specific hardware, software, search engines and social media to facilitate learning. Results for these aspects are presented in the following sub-sections 4.2.1 and 4.2.2 respectively.

4.3.1 Self-reporting on Applying Digital Literacy in Teaching Practices.

Table 4.4 presents the mean scores (M), standard deviations (SD) and significance test based on the independent sample t-test for each teacher rating on several aspects of applying digital literacy to facilitate learning. This is a comparative analysis in which the statistical significance of the differences in scores between teachers in Kenya and the Czech Republic are compared at a 95% confidence level.

Table 4.4: Teacher's application of digital literacy to facilitate learning.

	Kenya		**Czech Republic**		**Significance**	
Statements	**M**	**SD**	**M**	**SD**	**T-test**	**P-value**
I select suitable digital resources for teaching and learning, considering the specific learner's needs.	3.87	0.159	4.16	0.167	-17.21	0.012
I use digital technologies to guide and support learners	3.86	0.155	3.72	0.151	8.71	0.001
I share digital resources with my colleagues online.	3.82	0.159	3.55	0.151	16.48	0.001
I consider restrictions to the use or re-use of digital resources (e.g., copyright, file type, technical requirements, legal provisions, accessibility).	3.62	0.151	4.03	0.163	-25.41	0.023
I require learners to use digital technologies to interact among themselves in the learning environment.	3.57	0.156	2.87	0.135	44.53	0.001

I use digital technologies to record, compare and synthesize data on learner progress.	3.41	0.155	2.8	0.136	38.94	0.001
I use digital technologies to enhance assessment strategies, e.g., using computer-based tests, classroom response systems and quizzes, games	3.2	0.148	3.24	0.149	-2.58	0.010
I use digital technology to provide feedback to learners and their parents/guardians	3.1	0.145	3.04	0.144	3.97	0.000
I require learners to use digital technologies for self-assessment	3.22	0.150	2.56	0.130	43.65	0.001

The findings in Table 4.4 shows that teachers agreed that they select suitable digital resources for teaching and learning, considering the specific learner's needs with (*M=3.87, SD = 0.159*) and (*M = 4.16, SD =0.167*) for Kenya and the Czech Republic, respectively. A comparative analysis with (*p = 0.012*) on this response shows that teachers in the Czech Republic strongly agreed with the statement compared to their Kenyan Counterparts who agreed with the statement. A similar result the average score for teachers in the Czech Republic was higher compared to teachers in Kenya was observed on the aspect of considering possible restrictions to the use or re-use of digital resources (e.g., copyright, file type, technical requirements, legal provisions, accessibility) where (*M = 3.62, SD = 0.151*) and (*M = 4.03, SD = 0.163*) for Kenya and the Czech Republic, a statistically significant (*P = 0.023*).

On the other hand, some items such as using digital technologies to guide and support learners had higher mean scores among teachers in Kenya (*M = 3.86, SD = 0.155*) compared to their counterparts in the Czech Republic (*M= 3.72, SD = 0.151*), a statistically significant difference based on the p-value (*p = 0.001*) at 95% confidence level. Similar observations where the average scores for teachers in Kenya were higher than their counterparts in the Czech Republic were made on items such as requiring learners to use digital technologies to interact among themselves in the learning environment (*M = 3.57, SD = 0.156*) for Kenya versus (*M = 2.87, SD = 0.135*), a statistically significant difference (*p = 0.001*) and using digital technologies to record, compare and synthesize data on learner progress (*M = 3.41, SD = 0.155*) versus (*M = 2.8, SD = 0.136*), another statistically significant difference (*p = 0.001*).

Clearly from the results presented in Table 4.4, there are differences across each item between the two countries, with instances where each country outperforms the other. However, the two countries had different sample sizes, mean scores, and standard deviations and hence, need for data standardization for meaningful comparative analysis (Andrade, 2021). To examine the overall distribution of how teachers apply digital literacy to facilitate learning, the total scores of each teacher were computer and the total score was standardized by computing the z-scores as a single

indicator variable. Andrade (2021) contends that Z-scores transform the data to have a mean of zero and a standard deviation of one (Z ~ (0, 1)). Figure 4.1 presents a density distribution as a visual display of how teachers apply digital literacy to support learning.

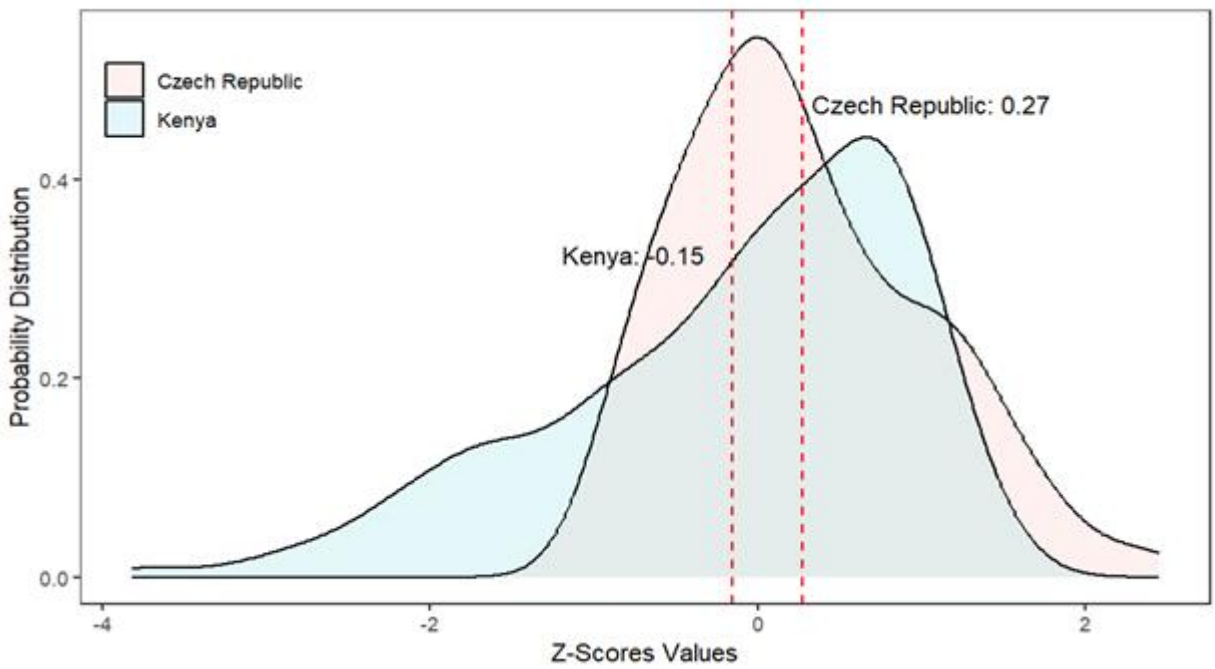

Figure 4.1: Distribution of how teachers use digital literacy to facilitate learning.

Results presented in Figure 4.1 shows that accounting for all measures of how teachers use digital literacy to facilitate learning, teachers from the Czech Republic are on average 27% above the average teacher in the study sample while teachers in Kenya are 15% below the average teacher. This shows a 42% gap in how teachers use digital literacy to facilitate learning between the two countries. Additionally, it is worth noting that whilst the overlap between the two countries is significant, Kenya is characterised by bigger proportions of teachers below average in the application of digital literacy to facilitate learning.

Additionally, Principal Component Analysis (PCA) was used to uncover subtleties in the structure of how teachers apply digital literacy to facilitate learning. Extraction based on eigenvalues resulted in two PCAs as presented in Figure 4.2. Based on these results, how teachers apply digital literacy can be categorized into ‘selection and use of digital resources’ and ‘integration of digital technologies in teaching and learning.’

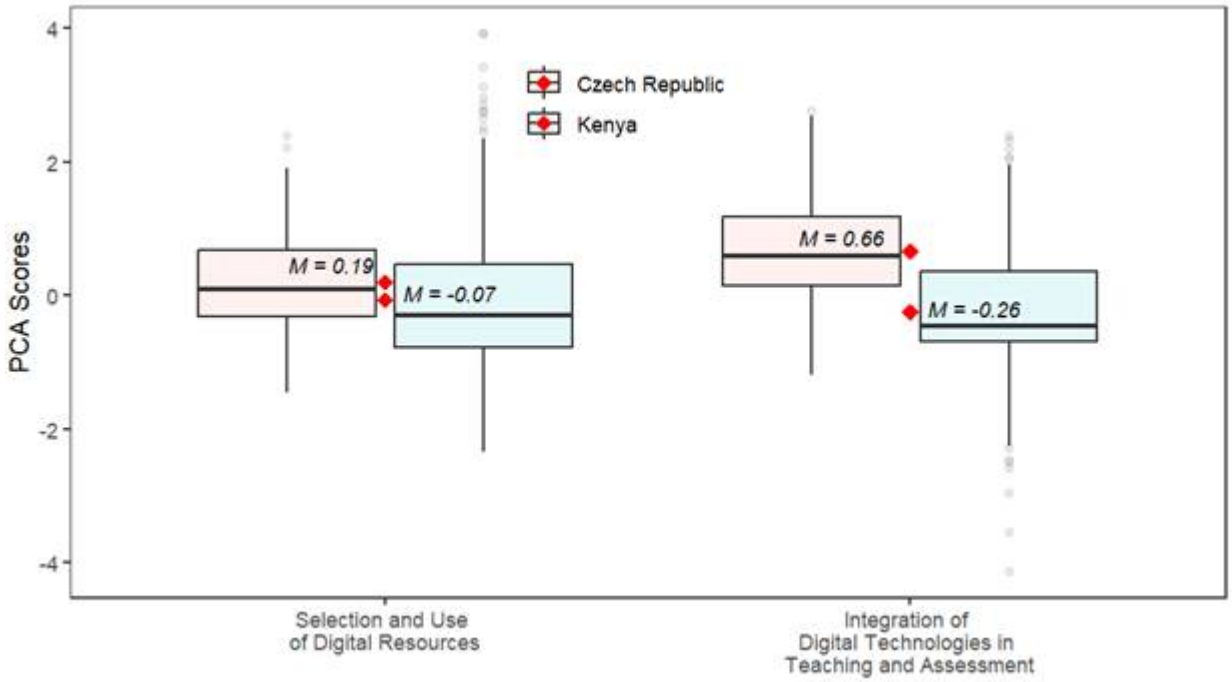

Figure 4.2: Principal Components of how teachers use digital literacy.

Conceptually, the selection and use of digital resources can be described as a requisite skill while the integration of digital technologies in teaching and assessment can be described as a pedagogical level application skill. The results in Figure 4.2 shows that concerning the selection and use of digital resources, the average score of teachers in the Czech Republic is 19% (*M = 0.26*) above the mean while the average score for teachers in Kenya is 7% (*M = -0.7*) below the mean. This results in a 26% gap in how teachers select and use digital resources. Regarding the integration of digital technologies in teaching and assessment, the results study shows that the average score for teachers in the Czech Republic is 66% (*M = 0.66*) above the average score while that of teachers in Kenya is 26% (*M = -0.26*) below the average score. This results in a 92% gap in how teachers in the two countries integrate digital technologies in teaching and assessment. These findings are in line with earlier studies such as Hlasna et al. (2017) on the use of ICT in Primary Education in the Czech Republic who found that 99% of respondents actively used ICT in classes, to stimulate pupils to learn, to test and evaluate pupils and to explain new subject matter. Almost three-quarters (57%) of the respondents use ICT very often, 27% several times a week, 15% only several times a month and only 1% never use ICT in classes. Furthermore, the findings also demonstrated that pupils considered the use of ICT in their classes as an inseparable, normal part of teaching to which they had already gotten used.

4.3.2 Self-reporting on the Use of Assorted Technologies

It may be recalled that the second aspect of how teachers use digital literacy to facilitate learning

encompassed the use of hardware, software, search engines and social media. Table 4.5 presents results on what teachers use to facilitate learning.

Table 4.5: Self-reporting on use of assorted technologies

	Total	Kenya	Czech Republic	χ^2	P-value
Hardware					
Smartphone	381(83.6%)	291(88.4%)	90(69.8%)	1.34	0.067
Laptop	317(69.5%)	197(59.9%)	120(93.0%)	6.46	0.000
Projector	222(48.7%)	153(46.5%)	69(53.5%)	0.44	0.295
Printer	191(41.9%)	80(24.3%)	111(86.0%)	35.23	0.000
Camera	178(39.0%)	116(35.3%)	62(48.1%)	1.62	0.045
Desktop computer	146(32.0%)	56(17.0%)	90(69.8%)	32.89	0.000
Television	142(31.1%)	101(30.7%)	41(31.8%)	0.01	0.852
Radio	116(25.4%)	94(28.6%)	22(17.1%)	1.72	0.038
Smart board	71(15.6%)	11(3.3%)	60(46.5%)	45.07	0.000
Software					
Android	358(78.5%)	279(84.8%)	79(61.2%)	2.46	0.013
Windows	281(61.6%)	155(47.1%)	126(97.7%)	16.4	0.000
iOS	33(7.2%)	6(1.8%)	27(20.9%)	19.64	0.000
Search Engines					
Google	371(81.4%)	264(80.2%)	107(82.9%)	0.09	0.643
Google Chrome	315(69.1%)	222(67.5%)	93(72.1%)	0.16	0.53
Opera mini	152(33.3%)	145(44.1%)	7(5.4%)	16.12	0.000
Firefox	132(28.9%)	65(19.8%)	67(51.9%)	13.64	0.000
Bing	24(5.3%)	14(4.3%)	10(7.8%)	0.75	0.178
Social Media					
YouTube	384(84.2%)	266(80.9%)	118(91.5%)	0.63	0.211
Facebook	189(41.4%)	145(44.1%)	44(34.1%)	0.86	0.145
Pinterest	117(25.7%)	19(5.8%)	98(76.0%)	72.22	0.000
TikTok	69(15.1%)	67(20.4%)	2(1.6%)	8.38	0.000
Instagram	46(10.1%)	34(10.3%)	12(9.3%)	0.04	0.743
Twitter	41(9.0%)	36(10.9%)	5(3.9%)	1.76	0.034
Snapchat	31(6.8%)	31(9.4%)	0(0.0%)	5.23	0.000

The findings in Table 4.5 shows that the most used hardware used in special schools included smartphone at 83.6%, laptop at 69.5% and projector at 48.7% while the least used hardware were Television, radio, and smart board at 31.1%, 25.4% and 15.4% respectively. In terms of proportional analysis of use, there is no statistically significant difference in the proportion of teachers using smartphones ($p = 0.067$), projects ($p = 0.295$) and Television ($p = 0.852$) in both countries at a 95% confidence level. There was a statistically significant difference ($p < 0.05$) in the proportion of teachers using laptops, printers, cameras, and desktop computers between the two countries in each case, with the Czech Republic having a bigger proportion than Kenya.

Previous studies, like Windshitl and Sahl (2002), have highlighted the transformative nature of

smartphones, which have evolved into versatile devices serving multiple functions such as personal mobile computers, cameras, and game systems. With features like multi-touch interfaces, GPS capabilities, and support for third-party applications, smartphones have become flexible tools that cater to various tasks including social networking, learning, and productivity. These devices have become indispensable in daily life, serving the transportation, communication, research, and entertainment needs. Moreover, Johnson et al. (2012) have observed that educational technology, specifically tablets and smartphones, offers a wide array of applications that educators are increasingly utilizing as learning tools in classrooms. This enables students to connect the curriculum with real-life issues. Similarly, Bernacki et al. (2020) emphasize the widespread prevalence of digital devices, particularly phones and tablets, in today's world. Developed countries exhibit a 96% ownership rate while developing countries show a 52% ownership rate.

Regarding the use of software, the study further found that the most common software included Android (78.5%) and Windows 61.6% while iOS was the least used software at 7.2%. There were statistically significant differences in the proportions of use of each software with Kenya leading the use of Android at 84.8% compared to the Czech Republic ($p = 0.013$). However, the proportion of Windows and iOS users was significantly higher in the Czech Republic ($p < 0.05$).

The main search engines used were Google (81.4%), Google Chrome (69.1%) and Opera Mini (33.3%) and Firefox (28.9%). Comparative analysis of proportions shows that there was no statistically significant difference in the proportion of Google ($p = 0.643$), Google Chrome ($p = 0.53$) and Bing ($p = 0.178$) between users between the two countries. However, there was a statistically significant difference in the proportion of users ($p < 0.05$) of Opera Mini and Firefox at 44.1% and 51.9% respectively. Earlier, Waks (2014) highlighted the internet as an immensely powerful tool that has revolutionized various aspects of society, including education. However, the true power of the internet lies not in the machinery itself, but in the users who harness its capabilities for creating, sharing, collaborating, and acting collectively. While the internet has opened numerous opportunities for educators, it is important to recognize that not all aspects of this technology are beneficial in the educational context. For instance, the presence of laptops in the classroom has been associated with poorer learning outcomes and a diminished perception of the value of education (Bayless, Clipson, & Wilson, 2013).

Finally, the most common social media users included YouTube (84.2%), Facebook (41.4%) and Pinterest (25.7%). Other hardware used included calculators, learners' digital devices, iPad, Manila papers, and tablets. Other software used included Ubuntu. Other social media mentioned included

Canva, Ka Hoot, Moodle, podcast, Veskole, WhatsApp, and Word wall. Research indicates that students are increasingly incorporating social media platforms into their academic experiences, both in formal and informal settings (Dabbagh & Kitsantas, 2012). This integration of social media is not limited to a specific demographic but has been observed among students of all age levels. YouTube has emerged as the most popular internet video distribution site, as highlighted by Dabbagh and Kitsantas (2011). Additionally, Pinterest has gained popularity as a social media platform that allows users to create collections called boards, where they can pin, and share photos related to diverse topics. These platforms enable individuals with internet access to freely share ideas and videos with their social networks and the wider online community. Notably, these sites are designed to be user-friendly and provide a diverse range of instructional content.

4.4 Self-Efficacy of Teachers in Digital Literacy

The second objective of this study was to assess self-efficacy in digital literacy among special primary school teachers of learners with disabilities in Kenya and the Czech Republic. As described in the variable measurement section, self-efficacy in digital literacy was measured using 15 Likert scale questions with 5 options; (1: Strongly disagree, 2: disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree). All the items were stated in a positive form; hence, higher numerical values would indicate higher efficacy in digital literacy while lower scores would indicate lower self-efficacy. Table 4.6 presents the mean scores, standard deviations, and statistical test of significance in differences between Kenya and the Czech Republic for each item.

Table 4.6: Self-Efficacy of Teachers in Digital Competencies

	Kenya		**Czech Republic**		**Significance**	
Statements	**M**	**SD**	**M**	**SD**	**T-test**	**P-value**
I use the internet to a reasonable extent in my professional communications	3.95	0.166	4.24	0.172	-16.55	0.001
I Successfully search for relevant digital information/content that I need	3.95	0.174	3.94	0.174	0.55	0.583
I retrieve digital information/content whenever I want	3.87	0.171	4.05	0.175	-10.01	0.002
I organize digital information/content the way I want	3.74	0.166	3.87	0.169	-7.46	0.040
I use digital technologies in collaborative processes for learning	3.88	0.161	3.48	0.153	24.10	0.002
I can share my content with other online users	3.73	0.168	3.78	0.169	-2.84	0.005
I use digital technologies to create innovative teaching approaches	3.75	0.159	3.63	0.156	7.26	0.016
I use technology for co-construction and	3.69	0.161	3.66	0.160	1.79	0.075

cocreation of learning resources and knowledge						
I create digital content in different formats e.g., documents using office tools like Ms. word, Excel & PowerPoint	3.48	0.169	4.20	0.184	-39.77	0.003
I protect learners against threats to their well-being in online environments e.g., cyberbullying	3.51	0.175	4.00	0.185	-26.38	0.012
I enable learners to understand risks and threats in digital environments (e.g., identity theft, fraud, stalking, phishing) and how to react appropriately	3.43	0.175	3.97	0.185	-29.06	0.008
I solve teaching and learning challenges using digital technologies	3.63	0.170	3.01	0.158	35.59	0.001
I am up to date with digital evolution	3.43	0.163	3.24	0.159	11.23	0.001
I secure digital information against unauthorized access	3.17	0.174	3.45	0.180	-15.25	0.013
I create online documents such as google docs, google forms etc.	2.95	0.168	2.78	0.164	9.75	0.001

Results presented in Table 4.6 shows that all except the item relating to successful searching of relevant digital information/content (*M = 3.95, SD = 0.174*) for Kenya and (*M = 3.94, SD = 0.174*) for the Czech Republic, p-value (*p =0.583*) are statistically significant. A comparison of the use of the Internet for professional communication between Kenya and the Czech Republic revealed that teachers in the Czech Republic used the Internet more for professional communication (M=4.24, SD = 0.172) compared to their Kenyan counterparts (M = 3.95). The findings also show that teachers agreed with the statement that they successfully search for relevant digital information/content that they need (*M = 3.95, SD = 0.166*), a statistically significant difference (*p = 0.001*).

A striking difference between Kenya and Czech Republic was realized in the statement that teachers create digital content in different formats e.g., documents using office tools like Ms. Word, Excel & PowerPoint whereas teachers in the Czech Republic were more advanced in this (*M = 4.20, SD = 0.184*) than Kenyan Counterparts (*M = 3.48, SD = 0.169*), another statistically significant difference between the two countries (*p = 0.003*). Teachers were neutral on the statement that they create online documents such as google docs, google forms etc (Mean 2.90). This is an indication that teachers in both countries were not conversant with the creation of online documents such as google forms.

Clearly from the results presented in Table 4.6, there are differences across each self-efficacy item between the two countries, with instances where each country outperforms the other. However, the

two countries had different sample sizes, mean scores, and standard deviations and hence, need for data standardization for meaningful comparative analysis (Andrade, 2021). To examine the overall distribution of self-efficacy in digital literacy among teachers, the total scores of each teacher were computed and the total score was standardized by computing the z-scores as a single indicator variable. Andrade (2021) contends that Z-scores transform the data to have a mean of zero and a standard deviation of one ($Z \sim (0, 1)$). Figure 4.3 presents a density distribution as a visual display of self-efficacy in digital literacy.

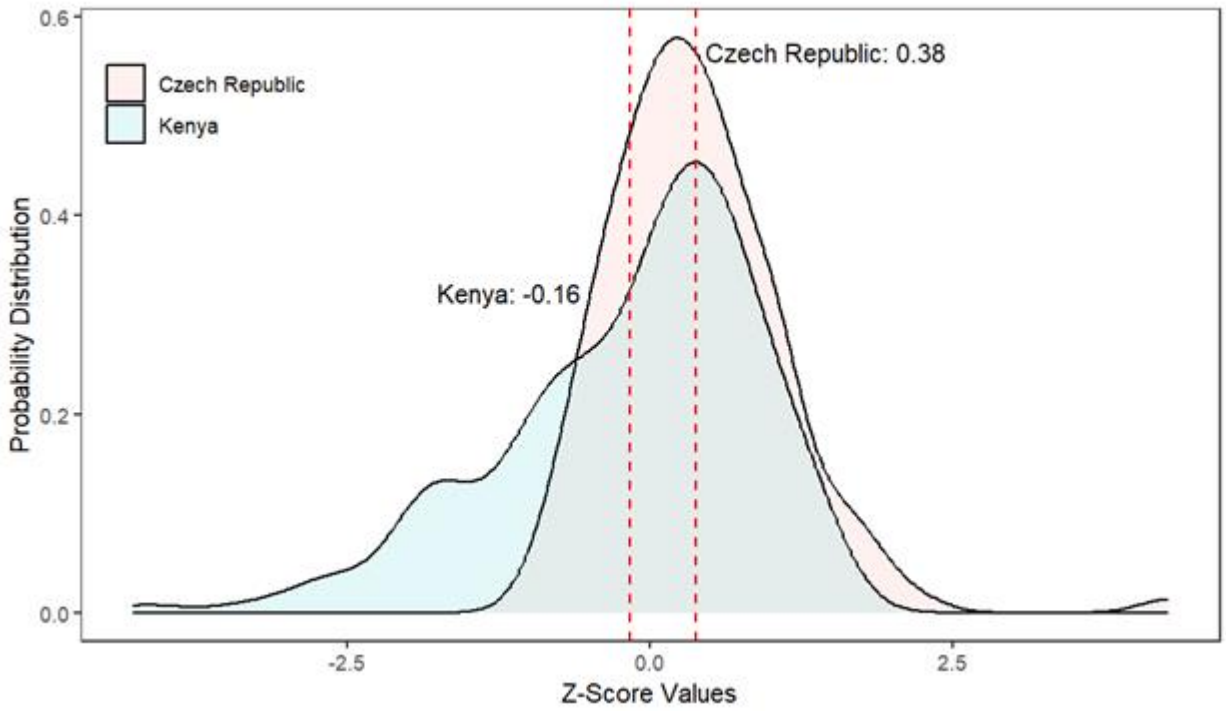

Figure 4.3: Distribution of self-efficacy in digital literacy among teachers

Results presented in Figure 4.3 shows that the average score of self-efficacies in digital literacy among teachers in the Czech Republic is 38% above the common mean while that of teachers in Kenya is 16% below the common mean. These results suggest a gap of 54% in self-efficacy in digital literacy among teachers in the two countries with the Czech Republic being ahead of Kenya.

Additionally, Principal Component Analysis (PCA) was used to uncover subtleties in the structure of self-efficacy in digital literacy among teachers. Extraction based on eigenvalues resulted in three PCAs as presented in Figure 4.4. Based on these results, self-efficacy in digital literacy can be categorized into ‘information retrieval and utilization, ‘digital content creation and collaboration’ and ‘digital safety and innovation’

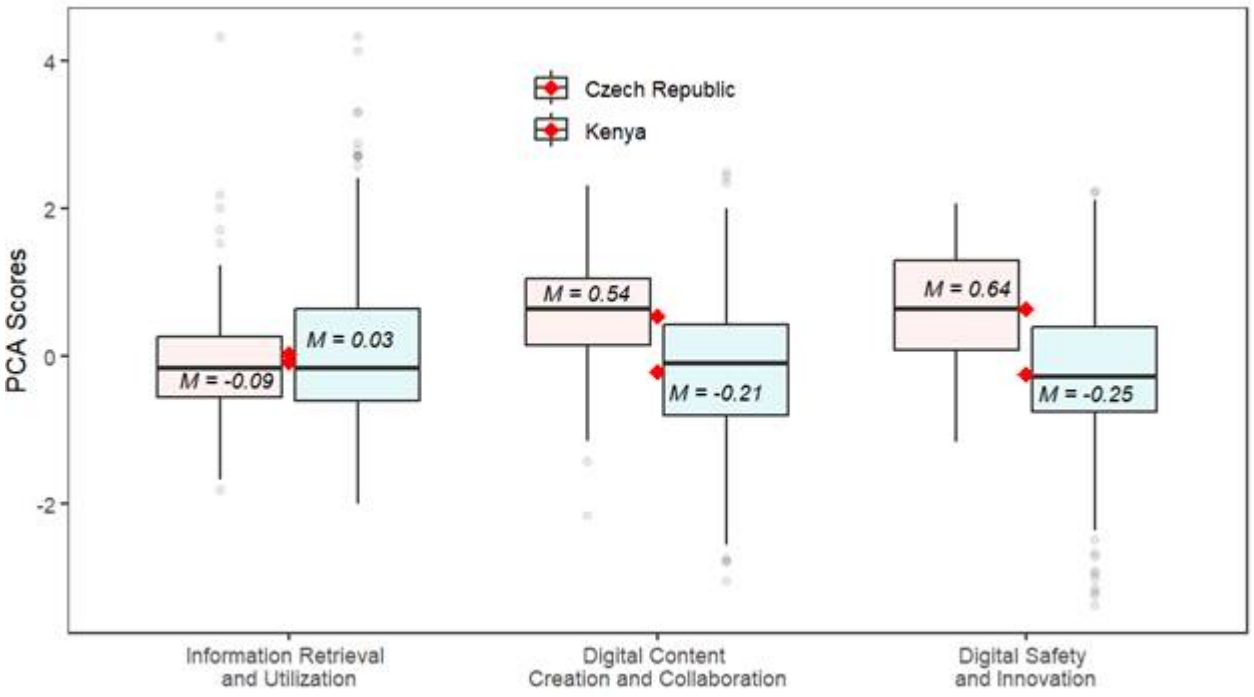

Figure 4.4: Principal Components of self-efficacy in digital literacy.

Conceptually, the three components presented in Figure 4.4 describes core competencies and concepts in digital literacy and hence dimensions of self-efficacy in digital literacy. Results show that regarding information retrieval and utilization, there is only a small difference in the averages between the two countries with Kenya having an average of 3% above the common mean while the Czech Republic has a mean of 9% below the common mean. This suggests a gap of 12% in teachers' self-efficacy in digital literacy as far as information retrieval and utilization is concerned. Regarding digital content creation and collaboration teachers in the Czech Republic were on average 54% above the common mean while teachers in Kenya were at an average of 21% below the mean, suggesting a gap of 75% between teachers in the two countries. Finally, on digital safety and innovation, teachers in the Czech Republic were 64% above the common mean while those in Kenya were 25% below the common mean, suggesting an 89% gap between teachers in the two countries.

4.5 Challenges in the Application of Digital Literacy in Facilitating Learning.

It may be recalled that the third objective of this study was to investigate the challenges to the application of digital literacy in class by teachers of learners with disabilities in special primary schools. This study established two levels of challenges faced by teachers in both countries that may constrain the application of digital literacy to facilitate learning. These are personal-level challenges

that relate to the individual teacher and the institutional-level challenges that relate to the learning environment. The findings of these challenges are presented in the subsequent subsections 4.4.1 and 4.4.2 respectively.

4.5.1 Personal level challenges to digital literacy

Table 4.7 presents the results of personal-level challenges in the application of digital literacy to facilitate learning in Kenya and the Czech Republic. Summary statistics in the form of the individual country mean and standard deviation for each country are presented alongside the significance test based on an independent sample t-test.

Table 4.7: Personal-level challenges to digital literacy

	Kenya		Czech Republic		Significance	
Statements	**M**	**SD**	**M**	**SD**	**T-test**	**P-Value**
I know how to use digital technologies for personal purposes	4.01	0.801	4.17	0.581	-2.05	0.041
I would like to receive more in-service training on digital competencies	4.16	0.847	3.61	0.461	6.93	0.014
The curriculum prescribes use/application of digital technologies in class	3.99	0.827	3.06	0.403	12.12	0.001
I have the technical skills that I need to utilize digital technologies to facilitate learning	3.56	0.713	3.83	0.464	-3.96	0.008
I am required to use digital technologies to facilitate learning	3.74	0.974	2.99	0.549	8.19	0.003
Digital technologies are expensive	3.70	0.878	2.91	0.454	9.65	0.001
I can afford digital technologies for use to teach/facilitate learning.	2.73	0.922	4.10	0.776	-14.84	0.001
I receive satisfactory in-service training on digital competencies	2.77	0.867	3.45	0.633	-8.05	0.007
All the required digital technologies are available in classes that I work in	2.47	0.845	3.54	0.654	-12.86	0.018
I have internet access in all classes that I teach at school.	2.21	0.689	4.13	0.581	-27.81	0.004
I prefer analogue to digital technology when facilitating learning	2.30	0.827	2.84	0.603	-6.70	0.006
Digital competence is for the digital generation/natives	2.27	0.879	2.84	0.642	-6.65	0.008
Use of digital technologies is too difficult for me	2.19	0.558	2.39	0.325	-3.80	0.000

The findings in Table 4.9 show that teachers strongly agreed that knowledge of the use of digital technologies for personal purposes was one of the factors influencing the application of digital literacy/competency to facilitate learning (*M = 4.01, SD = 0.801*) and (*M = 4.17, SD = 0.581*) in Kenya and the Czech Republic, respectively. Another factor was training as teachers strongly

agreed that they would love to receive more in-service training on digital competencies (*M=4.16, SD = 0.847*) and (*M = 3.61, SD = 0.461)* for Kenya and the Czech Republic, respectively. From the findings of the study, there was more demand for in-service training among teachers in Kenya compared to their counterparts in the Czech Republic. The findings are in line with the findings by OECD (2014) where they found that many Czech teachers (over 80%) report regularly participating in professional development activities. Teachers most frequently take part in short courses and workshops. Around one-third of teachers participate in a combination of formal mentoring, peer observation and/or coaching, which is just above the Teaching and Learning International Survey (TALIS) average. Many researchers point to factors such as inadequate teacher training, limited knowledge, and ineffective practices as reasons for the suboptimal utilization of technology and the Internet in educational settings (Riasati et al., 2012). These factors contribute to a lack of familiarity with technology tools and platforms, resulting in challenges in integrating them effectively into classroom instruction. Therefore, addressing these issues through comprehensive teacher training programs and promoting the acquisition of relevant knowledge and skills is crucial to improve the utilization of technology and the Internet in educational contexts.

In Kenya, for instance, Langat (2015) found that most of the teachers in the study on barriers hindering the implementation of ICT in primary schools in Kenya lacked computer literacy skills. Despite being aware of the importance of technology in education, the teachers blamed the government for the lack of effective planning to offer them in-service training on the use of technology in teaching and learning. From these findings, it can be deduced that better training or better supplementing of the current training through in-service training of teachers could be said to be of help in improving teachers' efficacy in digital literacy.

Other factors with the least influence on the application of digital literacy to facilitate learning in the two countries were the preference for analogue to digital technology to facilitate learning (*M = 2.30, SD = 0.827*) and (*M = 2.84, SD = 0.603*), the perception that digital competency is for the digital generation (Mean 2.43) and the perception that the use of digital technologies is too difficult (Mean 2,24). Research studies have explored the factors that significantly impact teacher self-efficacy with technology. One study found that teacher beliefs, computer proficiency, and readiness to embrace technology play a crucial role in the successful integration of technology in teaching (Inan & Lowther, 2010). Another study by Ertmer and Ottenbreit-Leftwich (2010) supports these findings and emphasizes the need for a shift in teachers' mindsets to recognize the essential role of information and communication technologies in effective teaching. These factors can be strengthened through training programs that enable teachers to develop their sense of self-efficacy

in utilizing technology effectively. Such training programs should focus on building teachers' confidence, knowledge, and skills in incorporating technology into their instructional practices.

There was a striking difference in the factors influencing the use of digital literacy to facilitate learning between the two countries. In terms of in-service training for teachers, the findings revealed that teachers in the Czech Republic had benefitted more than their Kenyan Counterparts (M= 3.45) as compared to Kenyan teachers who were neutral on the statement (M=2.77) an indication that much might not have been done in Kenya. In terms of Internet access, the findings revealed that teachers in the Czech Republic had more access to the Internet in their classrooms (M= 4.13) compared to their Kenyan counterparts (M = 2.21). Finally, in terms of the availability of digital technologies in classrooms, the findings revealed that teachers in the Czech Republic agree that the technologies were there (M = 3.54) compared to their Kenyan counterparts who were neutral on the statement (M = 2.47), an indication that the digital technologies were extremely limited in their classrooms.

To summarize personal-level challenges in the application of digital literacy, Principal Component Analysis (PCA) was used. Extraction based on eigenvalues resulted in three PCAs as presented in Figure 4.5. Based on these results, personal challenges in the application of digital literacy can be categorized into digital literacy & access; in-service training & competence; and preference & difficulty.

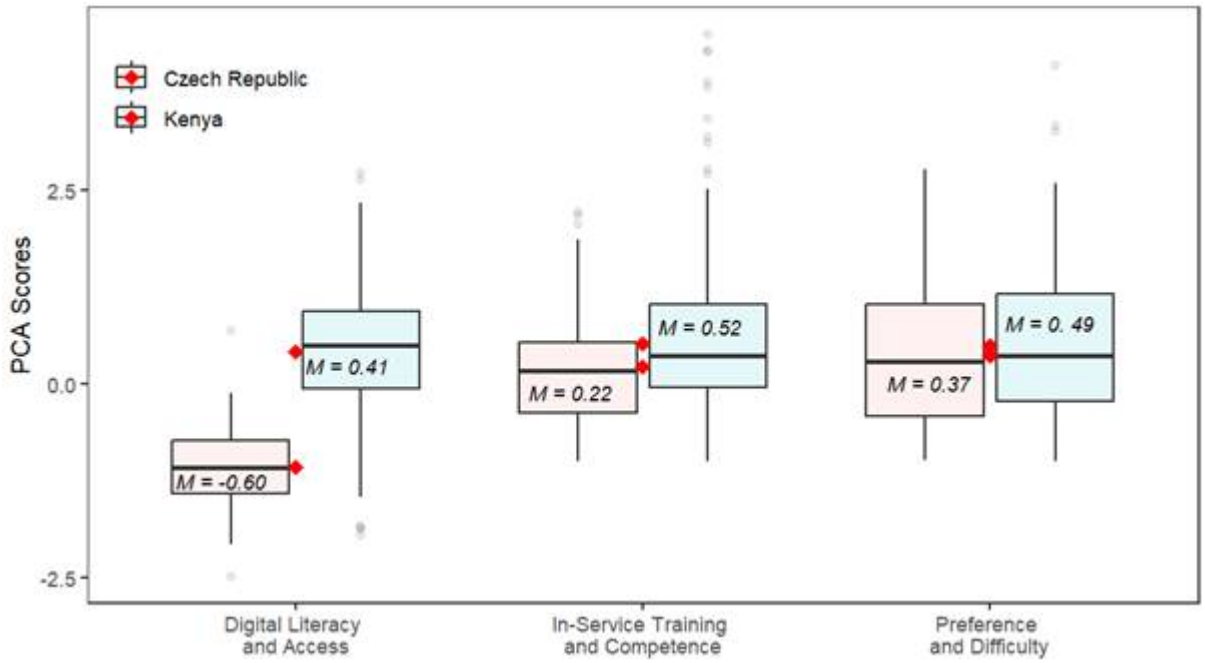

Figure 4.5: Principal Components of challenges teachers face in the application of digital literacy.

Results presented in Figure 4.5 show that the challenge of digital literacy and access is less severe

in the Czech Republic (60% below the common mean) compared to Kenya where the severity level is 41% above the common mean. The challenges related to in-service training and competence are less severe in the Czech Republic at 22% above the mean compared to Kenya where the average score of 52% above the mean, resulting in a gap of 30% between the two countries. Finally, the challenge related to preference and difficulty is equally less severe in the Czech Republic at 37% above the common mean compared to Kenya at 49% above the common mean. Teacher education programs commonly aim to equip pre-service teachers with technology proficiency.

Typically, these programs include an introductory course on technology as a prerequisite for entry into the education program. However, it is important to note that this single course does not adequately address the level of familiarity and competence required by teachers in their actual classroom settings. Several studies have found that while a technology-specific course helps develop basic computer skills, it does not adequately prepare educators to effectively integrate technology across various instructional contexts (Vannatta & Beyerbach, 2000). Having a separate course solely dedicated to technology may inadvertently suggest that computers and technology are separate from and not an integral part of instruction (Tutty, Klein, & Sullivan, 2005). Therefore, teacher education programs must go beyond a single technology course and provide comprehensive training and support to ensure that future educators are equipped to effectively integrate technology into their teaching practices.

4.5.2 Institutional-Level Challenges to Digital Literacy

The second level of challenges identified in this study were institutional-level challenges. Table 4.8 presents the results of institutional-level challenges which incidentally were various aspects of ICT infrastructure, school environment, curriculum requirements and other extrinsic factors within the learning environment. Results present the proportions of the severity of each challenge collectively, desegregated by country and test the statistical differences in the proportions between the two countries using the chi-square test.

Table 4.8: Institutional level challenges to digital literacy

Challenge	Total	Kenya	Czech Republic	χ^2	P-value
Limited skills in ICT use on the parts of the learners	290(63.6%)	210(63.8%)	80(63.0%)	0.01	0.920
Lack of ICT hardware in pupil's homes	282(61.8%)	222(67.5%)	60(47.2%)	6.07	0.014
Cost of Digital Technologies	239(52.4%)	204(62.0%)	35(27.6%)	20.74	0.000
Lack of ICT hardware in school	209(45.8%)	188(57.1%)	21(16.5%)	32.97	0.000

e.g., computers					
Time constraints	184(40.4%)	150(45.6%)	34(26.8%)	8.04	0.005
Overloaded curriculum content	171(37.5%)	149(45.3%)	22(17.3%)	19.11	0.000
Limited skills in ICT use on my part	143(31.4%)	126(38.3%)	17(13.4%)	18.13	0.000
Unreliable electricity supply	142(31.1%)	139(42.2%)	3(2.4%)	46.81	0.000
Congested classes/high learner-teacher ration	95(20.8%)	94(28.6%)	1(0.8%)	33.95	0.000
Lack/unclear policies and legislation	68(14.9%)	63(19.1%)	5(3.9%)	14.22	0.000
Unsupportive school administration	46(10.1%)	43(13.1%)	3(2.4%)	10.41	0.001
Pupils' dislike of digital technology	22(4.8%)	17(5.2%)	5(3.9%)	0.29	0.592

The findings in Table 4.8 shows that the main challenge to the application of digital literacy in facilitating special schools is limited skills in ICT use on the parts of the learners (63.6%). The significance test (p = 0.920) shows that the proportion of teachers who reported this challenge is not different between the two countries. This implies that teachers from both countries regard limited skills in ICT on the part of learners as a challenge for them to facilitate learning. A similar observation was made on the issue of student's dislike of technology where in both countries, the lowest number of teachers reported that pupils dislike digital technology at 5.2% and 3.9% in Kenya and the Czech Republic respectively, and these proportions are not statistically different from each other (*p =0.592*). This result shows that in both Kenya and the Czech Republic, dislike of technology by students is the least among the challenges faced by teachers to facilitate learning.

Lack of ICT hardware in pupil's homes was cited as a challenge by 67% of teachers in Kenya which is a significantly (p= 0.014) higher proportion compared to 47.2% in the Czech Republic. Other challenges included the cost of digital technologies (52.4%), lack of ICT hardware in schools (45.8%) and time constraints (40.4%). Other challenges mentioned by the respondents also included lack of internet connectivity, inability of learners to use digital content, lack of interest from parents and limited ICT resources. These findings are in line with that of Liang et al. (2005) who found that some basic facilities are fundamental for ICT integration. They posit that for effective use of technology in education classrooms should be equipped with learner's devices, teacher's devices, shared display projectors, network connectivity as well as other enabling installations. This argument is corroborated by Mingaine (2013) who notes that facilities such as power, computer devices, software, and connectivity are essential for effective ICT integration.

4.6 How Teachers Overcome Challenges in the Application of Digital Literacy.

It may be recalled that the fourth objective of this study was to explore how teachers of learners with disabilities overcome the challenges faced in the application of digital competencies. This was a follow-up question to study participants who had indicated that they faced any challenges regardless of whether they were personal-level or institutional-level challenges. The question was open-ended. The six-stage thematic analysis model proposed by Braun and Clarke (2006) was used to analyse the data as discussed in the data analysis section. Six key themes emerged from the data as described below. The results are presented per country.

4.6.1 How Teachers Overcome Challenges Faced in the Application of Digital Literacy in Kenya.

The results are presented in themes as with the challenges identified in the previous section.

i. **Theme 1: Utilizing available resources:** This is a strategy by some teachers who focus on using the resources that are already available to them. Some borrow ICT devices from neighbouring schools, share the few devices they have at their school, and encourage students to use their smartphones or laptops. They also make use of the school's computer lab and other available hardware. By utilizing what is already accessible, they can integrate digital skills into their teaching and assessment. Earlier studies such as Kim et al. (2017) on how to deal with the challenge of limited digital devices focussed on the ageing population. These challenges were also more related to privacy-related subjects and less to pedagogical aspects because it was unrelated to teaching and learning.

ii. **Theme 2: Seeking funding and support:** This strategy sought to address the challenge of acquiring ICT hardware and other resources by seeking funds and support from various sources. Some teachers said they reach out to well-wishers, request government funding, write proposals, and involve stakeholders to obtain the necessary resources. Some teachers also encourage parents to contribute financially or purchase devices for their children. Asking for parents to contribute either in cash or in kind towards resource mobilization for ICT resources and infrastructure is a typical cost-sharing model of education in Kenya and many developing countries in Sub-Sahan Africa (Majgaard & Mingat, 2012). By actively seeking funding and support, they aim to overcome the financial barriers associated with using digital skills in education.

iii. **Theme 3: Personal training and professional development:** This strategy was used by teachers who recognized the importance of their own training and professional development to effectively use digital skills in teaching and assessment. They attend seminars, workshops, and in-service courses to improve their ICT skills. Some teachers also consult with more experienced colleagues and experts in the field. By continuously learning and enhancing their skills, they are better equipped to overcome the challenges they face.

iv. **Theme 4: Time management and adaptation:** This strategy was adopted by teachers who emphasized the need for effective time management and adaptation to address the challenges of incorporating digital skills in teaching and assessment. They allocate specific time for digital activities, utilize break time, or free time, and adjust their teaching pace to accommodate the learners' abilities. Some teachers also reported that they created remedial classes or utilize alternative learning spaces to manage overcrowded classrooms. By managing time efficiently and adapting to the learners' needs, they strive to overcome the challenges they encounter.

v. **Theme 5: Collaboration and peer learning:** This strategy was embraced by teachers who recognized the power of communities of learning and peer support in overcoming challenges related to digital literacy. Some teachers said they consult with other colleagues, involve them in training learners, and encourage peer tutoring and group work among students. They also collaborate with stakeholders and engage parents in soliciting support for digital funds. By fostering collaboration and peer learning, they leverage collective knowledge and expertise to address challenges effectively.

vi. **Theme 6: Alternative Strategies:** This strategy focussed on exploring alternative methods and solutions when facing challenges with digital skills. Some reported that they resorted to using analogue teaching methods, alternative media (such as television), and locally available materials. Some teachers also teach basic digital skills at the learners' level and adapt the content into manageable units. Additionally, they may utilize solar power, generators, or other backup solutions to overcome electricity-related issues. By finding creative alternatives, they strive to overcome the challenges they encounter.

4.6.2 How Teachers Overcome Challenges Faced in the Application of Digital Literacy in the Czech Republic

There were significantly fewer responses from respondents in the Czech Republic compared to

those from their Kenyan counterparts in this area. The following are the themes that emerged from the data corpus.

i. **Theme 1: Borrowing from the School:** This was a recurring theme for respondents from the Czech Republic. This means that learners without devices to use at home could borrow devices from school and take them home to be able to undertake school assignments there. Teachers used statements like "Borrowing hardware from the school; …borrowing the necessary technologies; and… the school can lend a PC/Notebook but does not provide an Internet connection." This theme emerged especially in responses to how teachers resolve their challenges with a shortage of digital devices for learners in their homes.

ii. **Theme 2: Management's Responsibility:** In most of the areas that required active participation to adjust or make extra provision for learners, Czech teachers had a strong conviction that the school administration should be able to provide solutions, as opposed to them creating opportunities from existing resources. A considerable number made statements like "That is the task of the school management" or "I inform the school management" when responding to overcoming the challenges they had identified with. This could indicate that they had confidence in the capacity of school managers to provide solutions and resources. On the other hand, it could also indicate limitations in innovation and creativity on the part of those who passed all responsibility to the school administration.

iii. **Theme 3: Government Support:** Unlike their Kenyan counterparts who saw extra support in the light of donations and other contributions outside government sources, Czech teachers viewed the government as the main source of additional support based on their schools' needs. Respondents used phrases like "subsidy programs" and statements like "put pressure on the Ministry of Education and Culture to provide subsidies and grants." Such positions were seen to be indicative of the respondent's view that the government held the key to solutions to the issues that they were facing. One might say that Czech teachers expressed confidence in their government system to provide solutions.

iv. **Theme 4: Improving Digital Competencies:** Regarding combating challenges of limited ICT skills on the part of teachers and learners, the respondents expressed different strategies for improving their digital competencies. These were centred around learning new skills, improving the existing ones, and putting more practice. Expressions towards this included "*by constant repetition; constant practice;* By finding suitable activities to practice; and

more frequent use of ICT in teaching" to improve competencies on the part of learners. On their part, teachers used first-person language more to define what they do to improve their digital literacy. Their statements included statements like: "*When I discover something new that I can't do, I try to find someone to help me; I'm trying to improve; I am interested, cooperates with colleagues' further study in this area By self-study; and further training some training, paid for by the employer" respondents were willing and actively engaged in taking measures that allowed them to improve their DL.*

v. **Theme 5: Special Considerations for Learners with Disabilities:** Even though training for better digital literacy was central to responses related to improving DL, many respondents opined that it was not possible to solve the problem for learners with disabilities. Expressions towards this included: "the pupils' limited skills are due to their mental disabilities Due to the mental disability cannot be overcome help; cannot be overcome, the responses, respondents expressed strong sentiments regarding the possibility of learners with disabilities achieving the same digital competency levels as those without disabilities. Even though most of the respondents underscored the importance of developing DL skills, most of them proposed special consideration for learners with disabilities, especially mental disabilities, regarding what was expected of them as far as DL was concerned. Expressions like: "I will not burden them beyond their mental capacity; we are always looking for new ways to facilitate the use of ICT for pupils with severe disabilities; it is not possible to solve the problem, the pupils' limited skills are due to their mental disabilities; Due to the mental disability cannot be overcome; and cannot be overcome," were frequently used.

vi. **Theme 6: Alternative Strategies:** Czech teachers appeared to agree that schools in the country have digital devices even though not enough for all learners to use at the same time. For this reason, a considerable number recommended sharing of devices among other strategies, especially in response to inadequate hardware resources. Respondents used phrases like "children take turns; multiple students and one computer; alternate use" to describe the aspect of using the available resources to provide learning opportunities to all learners using the available resources.

An analysis of how teachers in the Czech Republic and Kenya overcome challenges presents a few similarities and differences. Overall, teachers in the Czech Republic have better access to resources, infrastructure, and funding. They can leverage this advantage to acquire specialized digital tools and assistive technologies tailored for students with disabilities. Additionally, they may have more

opportunities for professional development and training programs focused on inclusive education and digital literacy. On the other hand, teachers need to find innovative solutions due to limited resources. They can explore low-cost or open-source technologies, adapt existing devices, and seek collaborations with non-profit organizations or international initiatives aimed at supporting education in underprivileged areas. Local partnerships and community engagement can play a crucial role in bridging the digital divide and providing necessary support for teachers and students with disabilities in these contexts.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study was to establish and compare the level of digital literacy among teachers in special primary schools in Kenya and the Czech Republic, how they utilize the competencies to facilitate learning, as well as the strategies they put in place to overcome challenges faced in the process. This chapter presents a summary of the key findings, conclusions made based on the findings, recommendations, and suggestions for further research.

5.2 Summary of the Findings of the Study

This section presents a summary of the findings of the study based on the study objectives.

5.2.1 How teachers apply digital literacy to facilitate learning.

A comparative analysis of this response revealed that descriptive analysis of individual items shows statistically significant variations in the scores of each item, with each country outperforming the other in some instances. However, the overall results showed that based on self-reported ratings from teachers, it was found that how teachers in the Czech Republic apply digital literacy to facilitate learning is on average 27% above the common average of the two countries while how Kenyan teachers apply digital literacy to facilitate learning was 15% below the common average. How teachers applied digital literacy to facilitate learning could be categorised into two skill areas: 'selection and use of digital resources' and 'integration of digital technologies in teaching and learning.' It was found that in both skills areas, the teachers in the Czech Republic were better than Kenyan teachers on average with wider gaps on the integration of technology in teaching and assessment.

On the use of different ICT resources, the study found that the most common hardware used in special schools included a smartphone 83.6%, a laptop 69.5% and a projector 48.7%. The most common software included Android (78.5%) and Windows 61.6%. The main search engines used

were Google (81.4%), Google Chrome (69.1%) and Opera Mini (33.3%) and Firefox (28.9%). Finally, the most common social media used included YouTube (84.2%), Facebook (41.4%) and Pinterest (25.7%). Other hardware used included calculators, learners' digital devices, iPad, Manila papers, and tablets. Other software used included Ubuntu. Other social media mentioned included Canva, Ka Hoot, Moodle, podcast, Veskole, WhatsApp, and Word wall.

5.2.2 Self-efficacy in digital literacy among Teachers

Similarly, analysis of individual items showed statistically significant variations in the mean score of each item across the two countries, each country outperformed the other in different items. However, results show that the average score for self-efficacy in digital literacy for teachers in the Czech Republic was 38% above the common mean while the average score for Kenyan teachers was 16% below the common mean. It was also noted that despite significant overlaps between the self-efficacy scores for teachers in both countries, Kenya was characterised by a significant majority of teachers below the common mean.

The study found that the concept of self-efficacy for digital literacy could be grouped into three general areas namely '*information retrieval and utilization,'* '*digital content creation and collaboration'* and '*digital safety and innovation.'* Results in this study show that teachers from the Czech Republic had higher self-efficacy scores in all three areas compared to their Kenyan counterparts, However, there was a small gap between the two countries concerning information retrieval and utilization while the widest gap between the two countries was observed in the digital safety and innovation where the average score for Kenyan teachers was significantly lower compared to their counterparts from the Czech Republic.

5.2.3 Challenges to the Application of digital literacy to facilitate learning.

This study established that teachers in both Kenya and the Czech Republic face challenges at two levels. The first challenges were personal which relate to individual personality traits, competencies, and tendencies. The second level of challenges was the institutional level which relates to the learning environment and other external factors unlikely to be within an individual teacher's control. The main challenge to the application of digital literacy in facilitating in special schools was limited skills in ICT use on the parts of the learners (63.6%), lack of ICT hardware in pupil's homes (61.8%), cost of digital technologies (52.4%), lack of ICT hardware in schools (45.8%) and time constraints (40.4%). Other challenges mentioned by the respondents also included lack of internet connectivity, inability of learners to use digital content, lack of interest from parents

and limited ICT resources.

5.2.4 How teachers overcome challenges.

Despite the challenges, teachers devised some strategies to overcome them. The study revealed six broad areas including utilizing available resources, seeking funding and support, personal training and professional development, time management and adaptation, collaboration and peer learning and alternative methods and solutions. Some of the specific strategies included: seeking support from donors and the government to purchase them, borrowing from neighbouring schools and from home, using personal gadgets, children learning in turns, improvising and sharing the available resources, encouraging parents to buy the resources, asking pupils to go to cyber cafes, making use of what is available in school, asking learners to share, attending in-service training, asking assistance where necessary, going for ICT classes and hiring ICT experts, allowing learners to interact more with ICT resources, encouraging peer learning, integrating learning with digital technologies, organizing for remedial classes, teaching learner's elementary skills, breaking the curriculum into smaller units, employing more teachers, concentrating on accessible content, condensing learning activities, allocating more lessons for ICT, appealing for self-study among pupils, building more classrooms, using ICT devices when teaching, identifying some able learners to become teacher aids, use of alternative/backup sources of power such as solar power and generators, charging gadgets in advance and using power backups and by demystifying unclear policies.

5.3 Conclusions

The study concludes that teachers of students with disabilities in special primary schools in Kenya exhibit lower self-efficacy in digital literacy compared to their counterparts in the Czech Republic. This is evidenced by the difference in the usage of different technologies especially those regarding the creation of digital content in different formats e.g., documents using office tools like Ms. Word, Excel, and PowerPoint. Similarly, teachers in the Czech Republic have a better grasp of the basics of digital safety and innovation compared to their counterparts in Kenya, an attribute that is associated more with digital self-efficacy, but less with pedagogical practice in general. The study further concludes that teachers who selected suitable digital resources for teaching and learning tend to exhibit robust applications of digital literacy to facilitate the learning of students with disabilities. The ability to select suitable digital resources was exhibited more among teachers in the Czech context than in the Kenyan context.

Regarding challenges, teachers face when using digital literacy to facilitate the learning of students with disabilities, both Kenya and the Czech Republic face challenges, although of varying degrees. The challenges highlighted include limited skills in ICT use on the parts of the learners, lack of ICT hardware in pupil's homes, cost of digital technologies, lack of ICT hardware in schools, time constraints, lack of internet connectivity, the inability of learners to use digital content, lack of interest from parents and limited ICT resources. Teachers in Kenya reported greater challenges overall compared to their Czech counterparts. This included the availability of hardware and software technologies, as well as training. The challenges of access to digital resources were found to be great among teachers in Kenya, however, access was the least challenge reported by teachers in the Czech Republic. The challenges that were profound among teachers in the Czech Republic were the limited number of digital devices, teachers faced shortages since most students were forced to share a limited number of available digital devices.

The study finally concludes that some of the ways to overcome the challenges faced by teachers of learners with disabilities on the application of digital competencies included: seeking support from donors and the government, requesting parents to buy them, using personal gadgets, children learning in turns, improvising and sharing the available resources, asking pupils to go to cyber, making use of what is available in school, asking learners to share, attending in-service training, encouraging peer learning, integrating learning with digital technologies and identifying some able learners to become teacher aids. The striking difference between how teachers in Kenya and the Czech Republic approach the challenges they face is that in Kenya, teachers actively seek support from well-wishers and non-governmental organizations while in the Czech Republic, the government and private sector offer vibrant support.

5.4 Recommendations

5.3.1 Recommendations for Practice

This study adopted a comparative research paradigm, comparing digital literacy among teachers of learners with disabilities in Kenya and the Czech Republic. The findings of this study highlight trends in teachers' self-efficacy in digital literacy, the use of digital literacy to facilitate learning, and challenges and strategies used by teachers in both countries to overcome the challenges they face in their unique contexts. The findings uncover common underlying issues in digital literacy that are unique for pedagogical practice with students with disabilities across the two countries but also highlight greater disparities in digital literacy existing between teachers in Kenya and the Czech Republic. Based on these two-fold study findings, recommendations are made on common cross-

cutting issues, but practical implementations vary between the two countries.

a) Recommendations for Practical Issues in Kenya

i) Targeted digital in-service training for SNE: Teachers in Kenya cited inadequate in-service training as one of the major challenges to the application of digital technologies to facilitate the learning of students with disabilities. This is despite the training in digital literacy programmes (DLP). This study recommends training teachers of students with disabilities on the integration of digital technologies in special needs pedagogies including a selection of suitable digital resources. Teachers in special primary schools in Kenya ought to undergo further training through in-service programs specifically focused on enhancing their self-efficacy in digital literacy. These programs should be complementary to existing initiatives such as DLP but tailored to special needs and inclusive education pedagogies.

ii) Collaborative partnerships in strengthening infrastructural capacity: The study found that most schools did not have requisite infrastructure such as power and internet connectivity. This study recommends that the Directorate of special needs education (DSNE) in liaison with relevant education stakeholders form strategic partnerships with private service providers (both local and international) to build infrastructural capacity through alternative means such as solar panels and the use of mobile data.

iii) Seek support for ICT resources: The study found that teachers in Kenya resort to seeking help from donors and well-wishers to acquire basic ICT resources. Special needs schools in Kenya should actively seek support from relevant stakeholders, such as the government and non-governmental organizations to ensure the availability and accessibility of ICT resources for promoting inclusive education. The DSNE through the Ministry of Education (MOE) can also establish partnerships with governments in developed economies for donation of ICT resources particularly hardware which was found to be among the biggest constraints in Kenya, while countries like the Czech Republic do not face similar challenges.

iv) Promotion of peer learning through communities of practice (CoP): It was found that there is a wide gap in Kenya such that there are teachers who are excellent in digital literacy and also a significant majority who are poor in digital literacy. This study recommends the promotion and regularization of communities f practice as a means of strengthening peer learning. Through communities of practice, teachers can learn hands-on skills from each other without the necessity of formal training. Transferable pedagogical skills through peer learning and communities of practice can help reduce the wide that currently exists in Kenya regarding digital literacy.

b) Recommendations for Practical Issues in the Czech Republic

i) Comprehensive induction programmes: The study found that some teachers in the Czech Republic failed to utilize the latest equipment and/or software to facilitate learning due to limited expertise on the latest technologies. This study recommends that upon the acquisition of new devices/equipment or software, a comprehensive induction programme is needed to enable optimal utilization of new technologies to facilitate the learning of students with disabilities.

ii) Enhance equitable distribution of ICT resources: The study found that despite the availability of digital devices in most schools, teachers raised issues of inadequacy. This study recommends that special schools in the Czech Republic should be facilitated to have enough of the necessary ICT devices to match the number of students in class. This relates particularly to portable devices that were not adequate for all the learners in some schools.

iii) Promote technical expertise in the classroom: The study found that some teachers needed technical support in handling sophisticated digital devices for example set up and configuration, so that they focus on pedagogical aspects of using technology without the hustle of technical details. This study recommends enhancing technical support for teachers, especially in classrooms that have multiple disabilities.

5.3.2 Recommendations for Policy

This study revealed gaps between Kenya and the Czech Republic regarding teacher application of digital literacy to facilitate learning in the context of their self-efficacy. In terms of comparison, the two countries may seem widely apart, however, there are common policy-level issues that both countries can adopt to further strengthen their digital use to promote the use of digital technologies in inclusive schools.

i) Both countries to consider developing and implementing a training program that focuses on digital literacy skills tailored for teachers working with special needs students. This program should provide hands-on training on using digital tools and technologies, assistive technologies, accessible online resources, and strategies for inclusive instruction.

ii) Both countries to consider strengthening professional support networks or communities of practice among teachers working in special needs and inclusive education. These networks can facilitate knowledge sharing, collaboration, and the exchange of best practices in utilizing digital technology to support students with diverse needs.

iii) Both countries to consider developing incentives for the dissemination of inclusive digital resources and materials that cater to a range of special needs. Provide funding and support

for the creation of accessible digital content, such as e-books, multimedia materials, and interactive learning resources that address diverse learning styles, abilities, and disabilities.

iv) Both countries to consider regular and independent evaluation and monitoring of the implementation of policies and programmes related to the usage of digital technologies for special needs and inclusive education.

v) Both countries to consider strengthening their systems to recognize merit by for example incentivizing teachers who demonstrate high self-efficacy to use digital technology to promote special needs and inclusive education.

5.3.3 Recommendations for Further Research

This was a comparative study on digital literacy among teachers of learners with disabilities in Kenya and the Czech Republic. Following the evidence on a wide digital divide between the two countries, the study recommends further research exploring opportunities to address digital deficits particularly in Kenya to promote uptake of digital resources for special: and inclusive education. Similar research could be done in the Czech Republic but with a focus on enhancing automatization to improve software updates to meet the specific requirements of learners with disabilities as they arise.

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APPENDICES

Appendix I: Questionnaire for Primary School Teachers

Dear participant,

Re: Digital Literacy among Primary School Teachers of Learners with Disabilities in Kenya and Czech Republic.

My name is Martin Mwongela Kavua, a PhD candidate at Charles University, Prague, Czech Republic. I am conducting research to examine digital literacy among primary school teachers of learners with disabilities in Kenya and Czech Republic, and I am inviting you to participate in filling this questionnaire. Participation in the research is entirely voluntary. Data collected was integrated into a single report for my doctoral thesis and related academic publications. Whilst there are no direct benefits for participation in the interview, data generated was useful in advancing intra and inter country discourses on digital literacy as a 21st century core competency and a precursor for lifelong learning. Relevant authorizations to conduct this research have been obtained.

Respondent consent:
Having understood the above information and knowledge of the interview, confidentiality and anonymity guaranteed, I hereby consent to participate in the study.

Participant's signature: _____ Date: _____
There shall be provision for a button to be clicked by those who will participate through digital media
Statement and button for giving consent.
Thank you for your participation.

Demographic Data

1. Are you?
   - Male
   - Female
2. In which country are you teaching?
   - Kenya
   - Czech Republic
3. How many years have you been teaching?
   - Under 5 years
   - 6-10
   - 11-15
   - 16-20
   - 21-25
   - 26 or more
4. Name of the school: ……
5. Which of the following subjects do you teach?
   Multiple answers are possible
   - Foreign Language(s) e.g., English

- Indigenous languages e.g., Czech, Kiswahili, Czech Sign Language and Kenyan Sign Language
- Literacy
- Mathematics
- Science(s) e.g., hygiene and nutrition
- Arts e.g., Music, Social, Studies, creative art
- Religious Education
- Others (Specify) ----------

6. If yes, what disabilities?
   Multiple answers are possible
   - Hearing Impairment (hard of hearing to deafness).
   - Visual Impairment (low vision to blindness)
   - Deaf – blindness
   - Physical Impairment
   - Intellectual and developmental disabilities
   - Specific learning disabilities (dyslexia, dyscalculia, dysgraphia)
   - Cerebral Palsy
   - Speech and language difficulties
   - Multiple disabilities
   - Autism
   - Albinism

7. What is the average age of majority of the students you teach?
   Multiple answers are possible
   - 6 and below
   - 7 to 9
   - 10 to 12
   - 13 to 15
   - 16 to 18
   - 19 and older

Section A: Application of Digital Competency to Facilitate Learning

Respondents were evaluated on their practical use of digital competencies to facilitate learning. Three questionnaire items were drawn from the following DigCompEdu proficiency areas: 2 – Digital Resources; 3 – Teaching and Learning; 4 – Assessment; 6 namely Facilitating Learners Digital Competence.

To answer the questions below, select from the options described as you deem appropriate.
1= Strongly Disagree 2 = disagree 3 = Neither agree or disagree 4 = Agree 5= strongly agree

		1	2	3	4	5
1.	I select suitable digital resources for teaching and learning, considering the specific learning context and learning objective.					
2.	I consider restrictions to the use or re-use of digital resources (e.g., copyright, file type, technical requirements, legal provisions, accessibility).					
3.	I share digital resources with my colleagues online.					
4.	I use digital technologies to guide and support learners					

5.	I use require learners to use digital technologies to interact among themselves in the learning environment.					
6.	I require learners to use digital technologies for self-assessment					
7.	I use digital technologies to enhance assessment strategies, e.g., using computer-based tests, classroom response systems, quizzes, games					
8.	use digital technologies to record, compare and synthesize data on learner progress.					
9.	I use digital technology to provide feedback to learners and their parents/guardians					

1. I use the following technologies to support learning in class
   Multiple answers are possible
   - Hardware
     - Desktop computer
     - Laptop
     - Smartphone
     - Radio
     - Television
     - Projector
     - Smart board
     - Camera
     - Printer
   - Software
     - Windows
     - iOS
     - Android
     - Others (Specify)
   - Search engines
     - Google
     - Bing
     - Google Chrome
     - Firefox
     - Opera mini
     - Others (Specify) …….
   - Social media
     - Youtube
     - Facebook
     - Instagram
     - Twitter
     - Tiktok
     - Pinterest
     - Snapchat
     - Others (Specify)

Section B: Self-Efficacy of Teachers in Digital Competencies

The 15 test items below are classified into 5 components of DigiComp, which are like the 5

components of area 6 of DigCompEdu. They are drawn from the set activities for each level. Each area (i.e., Information, Communication, Content Creation, Safety/responsible use, Problem solving in DigCompEdu Framework; and Information and media literacy, Communication, Content creation, Responsible use, and Problem solving in DigCompEdu) with 3 questions structured in the same sequence.

1= Strongly Disagree 2 = disagree 3 = Neither agree or disagree 4 = Agree 5= strongly agree

		1	2	3	4	5
1	I successfully search for relevant digital information/content that I need					
2	I retrieve digital information/content whenever I want					
3	I organize digital information/content the way I want					
4	I use the internet to reasonable extent in my professional communications					
5	I use digital technologies in collaborative processes for learning					
6	I use technology for co-construction and cocreation of learning resources and knowledge.					
7	I create digital content in different formats e.g., documents using office tools like Ms. word, Excel & PowerPoint.					
8	I create online documents such as google doc, google forms etc					
9	I can share my own content with other online users					
10	I secure digital information against unauthorised access					
11	I enable learners to understand risks and threats in digital environments (e.g., identity theft, fraud, stalking, phishing) and how to react appropriately					
12	I protect learners against threats to their well-being in online environments e.g., cyberbullying.					
13	I solve teaching and learning problems using digital technologies					
14	I use digital technologies to create innovative teaching approaches					
15	I am up to date with digital evolution					

Section C: Factors Influencing Teachers' Application of Digital Literacy/Competencies to Facilitate Learning

To answer the questions below, select from the options described as you deem appropriate.

I apply digital technologies to facilitate learning if: (*choose one option from 1= Strongly Disagree 2 = disagree 3 = Neither agree or disagree 4 = Agree 5= strongly agree below)*

			1	2	3	4	5
	1.	I know how to use digital technologies for personal purposes					
	2.	I have the technical skills that I need to utilize digital technologies to facilitate learning					
	3.	The digital technologies are available in class(es) I work in					
	4.	I am required to use digital technologies					

5.	The curriculum prescribes use/application of digital technologies in class					
6.	I can afford digital technologies					
7.	I have internet access					
8.	I receive satisfactory in-service training on digital competencies					
9.	I prefer analogue to digital technology when facilitating learning.					
10.	Digital competence is for the digital generation/natives					
11.	I would like to receive more in-service training on digital competencies					
12.	Use of digital technologies is too difficult for me					
13.	It is expensive to acquire digital competencies					
14.	Digital technologies are expensive					

Section D: Overcoming Challenges Faced in Application of Digital Literacy in Facilitating Learning

1. What challenges do you face when applying digital competencies and technologies in class? *Multiple answers are possible*
    - Lack of ICT hardware in school e.g., computers
    - Lack of ICT hardware in pupil's homes
    - Cost of Digital Technologies
    - Limited skills in ICT use on my part
    - Limited skills in ICT use on the parts of the learners
    - Overloaded curriculum content
    - Time constraints
    - Congested classes/high learner-teacher ration
    - Unreliable electricity supply
    - Lack/unclear policies and legislation
    - Pupils' dislike of digital technology
    - Unsupportive school administration
    - Others (Specify) ……
2. How do you overcome the challenges mentioned above? Name the challenge and how you resolve it.
    a. ……
    b. ……
    c. ……
    d. ……

e. ……

Thank you!

Appendix II: Dotazník Pro Učitele Základních Škol

Vážení participanti,

Digitální gramotnost učitelů žáků se speciálními vzdělávacími potřebami na základních školách v Keni a České republice

Úvod

Jmenuji se Martin Mwongela Kavua a jsem doktorandem na Univerzitě Karlově v Praze, v České republice. Provádím výzkum, který zkoumá digitální gramotnost mezi učiteli žáků se speciálními vzdělávacími potřebami na základních školách v Keni a České republice. Tímto vás vyzývám k účasti na vyplnění tohoto dotazníku. Účast na tomto výzkumu je zcela dobrovolná. Shromážděná data budou sloužit pro výzkumné účely mé doktorské práce a zprávu v souvisejících akademických publikacích. Dotazník je zcela anonymní, žádné názvy institucí či jména zúčastněných jedinců nebudou zveřejněna. Přestože z účasti ve studii nejsou žádné přímé výhody, získaná data budou užitečná při prosazování diskurzů o digitální gramotnosti v rámci jednotlivých zemí i v zahraničí jako klíčové schopnosti 21. století a předchůdce celoživotního učení. Příslušná oprávnění k provádění tohoto výzkumu byla získána.

Souhlas respondenta

Poté, co jsem porozuměl výše uvedeným informacím, s ujištěním, že je zaručena důvěrnost a anonymita, souhlasím s účastí ve studii.

Podpis participanta: _____Datum: _____

There shall be provision for a button to be clicked by those who will participate through digital media
Děkuji za vaši účast.

Demografické údaje

Jaké je vaše biologické pohlaví?

- žena
- muž

V jaké zemi učíte?

- ❒ Keňa
- ❒ Česká republika

Kolik let učíte?

- ❒ méně než 5 let
- ❒ 6-10
- ❒ 11-15
- ❒ 16-20
- ❒ 21-25
- ❒ 26-30
- ❒ 31 a více

Název školy: ……

Které z následujících předmětů vyučujete?
(možnost zaškrtnout více odpovědí)

- Cizí jazyk, např. angličtina
- Jazyk, např. Český jazyk, Kiswahili, český znakový jazyk a keňský znakový jazyk
- Literatura
- Matematika
- Člověk a příroda-vlastivěda, přírodověda atd.
- Umění a kultura, např. Hudební výchova, Výtvarná výchova
- Náboženství
- Jiné (specifikujte) ……

Pokud ano, s jakým znevýhodněním?
(možnost zaškrtnout více odpovědí)

- sluchové postižení (nedoslýchavost až hluchota)
- zrakové postižení (slabozrakost až nevidomost)
- Hluchoslepota
- Tělesné postižení
- Mentální a vývojové postižení
- Specifické poruchy učení (dyslexie, dyskalkulie, dysgrafie)
- Dětská mozková obrna
- Narušená komunikační schopnost
- Kombinované postižení
- Autismus
- Albinismus
- ADHD

Jaký je průměrný věk většiny dětí, které učíte?
(možnost zaškrtnout více odpovědí)

- 6 a méně
- 7 až 9
- 10 až 12
- 13 až 15
- 16 až 18
- 19 a starší

Oddíl A: Využití a aplikace digitálních kompetencí k usnadnění výuky

Respondenti budou hodnoceni z hlediska praktického využití digitálních kompetencí k usnadnění učení. V dotazníku byly vybrány tři položky z následujících oblastí znalostí DigCompEdu: 2 – Digitální zdroje ; 3 – Výuka ; 4 – Digitální hodnocení; 6 – Podpora digitálních kompetencí žáků

K odpovězení níže uvedených otázek, vyberte možnost, kterou uznáváte za vhodnou.
1= Naprosto nesouhlasím 2 = Nesouhlasím 3 = Ani nesouhlas ani souhlas 4 = Souhlasím 5= Naprosto souhlasím

		1	2	3	4	5

1	Vybírám vhodné digitální zdroje pro výuku s ohledem na konkrétní výukový kontext a výukový cíl.					
2	Zvažuji možná omezení použití nebo opětovného použití digitálních zdrojů (např. autorská práva, typ souboru, technické požadavky, právní ustanovení, dostupnost).					
3	Sdílím digitální zdroje se svými kolegy online					
4	K vedení a podpoře žáci používám digitální technologie					
5	Vyžaduji, aby žáci používali digitální technologie ke vzájemné interakci ve vzdělávacím prostředí					
6	Požaduji, aby žáci používali digitální technologie k sebehodnocení					
7	Používám digitální technologie k vylepšení strategií hodnocení, např. pomocí počítačových testů, systémů odezvy ve třídě, kvízů, her					
8	Používám digitální technologie k záznamu, porovnávání a syntéze dat o pokrocích žáků.					
9	Používám digitální technologie k poskytování zpětné vazby žákům a jejich rodičům/zákonným zástupcům					

Využívám následující technologie k podpoře výuky ve třídě:
(možnost zaškrtnout více odpovědí)

- Hardware
  - Stolní počítač
  - Notebook
  - Chytrý telefon
  - Radio
  - Televize
  - Projektor
  - Smart board
  - Fotoaparát
  - Tiskárna
- Software
  - Windows
  - iOS
  - Android
  - Jiné (specifikujte)
- Vyhledávače
  - Google
  - Bing
  - Google Chrome
  - Firefox
  - Opera mini
  - Jiné (specifikujte) …….
- Sociální média
  - Youtube
  - Facebook
  - Instagram
  - Twitter
  - Tiktok

- Pinterest
- Snapchat
- Jiné (specifikujte)

Oddíl B: Sebedůvěra učitelů v digitálních kompetencích

15 testovacích položek je rozděleno do 5 komponentů digitálních kompetencí, které jsou shodné s pěti komponenty 6. oblasti Evropského rámce DigCompEdu. Čerpají především ze stanovených aktivit pro jednotlivé úrovně. Každá oblast (Informační a mediální gramotnost, digitální komunikace a spolupráce, tvorba digitálního obsahu, odpovědné využívání digitálních technologií, řešení problémů prostřednictvím digitálních technologií) s třemi otázkami jsou strukturovány ve stejném pořadí.

1= Naprosto nesouhlasím 2 = Nesouhlasím 3 = Ani nesouhlas ani souhlas 4 = Souhlasím 5= Naprosto souhlasím

		1	2	3	4	5
1	Úspěšně vyhledávám relevantní digitální informace/obsah, které potřebuji					
2	Vyhledám si digitální informace/obsah kdykoliv chci					
3	Organizuji digitální informace/obsah tak, jak chci					
4	Při své profesní komunikaci využívám v přiměřené míře internet					
5	Používám digitální technologie v kolaborativních procesech při výuce					
6	Využívám technologie ke společné konstrukci a společné tvorbě výukových zdrojů a znalostí.					
7	Vytvářím digitální obsah v různých formátech např. dokumenty v MS Word, Excel & PowerPoint.					
8	Vytvářím online dokumenty jako je google doc, google forms atd					
9	Dokážu sdílet svůj vlastní obsah s dalšími online uživateli					
10	Zabezpečuji digitální informace proti neoprávněnému přístupu					
11	Umožňuji žákům porozumět rizikům a hrozbám v digitálním prostředí (např. krádež identity, podvod, pronásledování, spam) a jak ně správně reagovat					
12	Chráním žáky před ohrožením v online prostředí, např. kyberšikanou.					
13	Výukové a učební problémy řeším pomocí digitálních technologií					
14	Používám digitální technologie k vytváření inovativních výukových přístupů					
15	Jsem dobře informovaný o digitální revoluci					

Oddíl C: Faktory ovlivňující používání digitální gramotnosti/kompetencí učiteli k usnadnění učení

K odpovězení níže uvedených otázek, vyberte možnost, kterou uznáváte za vhodnou.
Využívám digitální technologie k podpoře učení jestliže:
1= Naprosto nesouhlasím 2 = Nesouhlasím 3 = Ani nesouhlas ani souhlas 4 = Souhlasím 5= Naprosto souhlasím

		1	2	3	4	5
1	Vím, jak používat digitální technologie pro osobní účely					
2	Mám technické dovednosti, které potřebuji k využívání digitálních technologií k usnadnění výuky					
3	Ve třídě, v které učím, jsou dostupné digitální technologie					
4	Jsem povinen používat digitální technologie					
5	Učební plán předepisuje použití/aplikaci digitálních technologií ve třídě					
6	Mohu si dovolit digitální technologie					
7	Mám přístup k internetu					

Následující tvrzení jsou pravdivá

8	Absolvuji uspokojující školení v digitálních kompetencích					
9	Při usnadnění výuky preferuji analogovou před digitální technologií					
10	Digitální kompetence je pro digitální generaci					
11	Rád bych absolvoval další školení o digitálních kompetencích					
12	Digitální technologie jsou pro mě příliš obtížné					
13	Získat digitální kompetence je drahé					
14	Digitální technologie jsou drahé					

Oddíl D: Překonávání výzev, kterým čelí aplikace digitální gramotnosti při usnadňování učení

3. Jakým výzvám čelíte při uplatňování digitálních kompetencí a technologií ve třídě? *(možnost zaškrtnutí více odpovědí)*

- Nedostatek hardwaru ICT ve škole, např. počítače
- Nedostatek ICT hardwaru v domovech žáků
- Náklady na digitální technologie
- Omezené dovednosti v používání ICT z mé strany
- Omezené dovednosti v používání ICT ze strany žáků
- Přehlcený obsah učiva
- Časové omezení
- Přeplněné třídy / vysoký poměr studentů a učitelů
- Nespolehlivá dodávka elektřiny
- Nedostatek/nejasná politika a legislativa
- Nechuť žáků k digitálním technologiím
- Nepodporující vedení školy
- Jiné(specifikujte) ……

Jak překonáváte výše uvedené výzvy? Pojmenujte výzvu a jak ji vyřešíte.

a. ……..
b. ……..
c. ……..
d. ……..

Děkuji!

Appendix III: Observation Checklist for Use Digital Technologies by Teachers in Special/Independent Schools

Part I: Administrative Details

1. Date of Observation (yyyy-mm-dd)
2. Name of the Observer …….
3. Country
   - ❒ Kenya []
   - ❒ Czech Republic []
4. County/Region/Kraj …….
5. School name …….
6. Class/Grade …….

Part II: Bio Data

7. Teacher's gender (being observed)
   - ❒ Male []
   - ❒ Female []
   - ❒ Other (*Specify*)…….
8. Teacher's age (years) ……
9. How many years have you been teaching?
   - ❒ Under 5 []
   - ❒ 6 – 10 []
   - ❒ 11 – 15 []
   - ❒ 16 – 20 []
   - ❒ 21 – 25 []
   - ❒ 26 – 30 []
   - ❒ 31 or more []
10. What is your academic/professional qualification? (*Please record only that which is completed and certified*)
    - ❒ Certificate []
    - ❒ Diploma []
    - ❒ Undergraduate Degree []
    - ❒ Master's Degree []
    - ❒ PhD []
    - ❒ Other (*Specify*)……
11. Number of learners in the class
    - ❒ Male …….
    - ❒ Female …….
12. Subject being taught during the observation …….

Part III: Infrastructure, Hardware, and Software

13. The school had a source of electricity/power supply

- ❒ Yes []
- ❒ No []

14. Categories of Learners with Disabilities in the school (*Multiple answers are possible*)
    - ❒ Hearing Impairment (*Hard of hearing to deafness*) []
    - ❒ Visual Impairment (*Low vision to blindness*) []
    - ❒ Deaf-Blindness []
    - ❒ Physical Impairment []
    - ❒ Intellectual and Development Disabilities []
    - ❒ Specific Learning Disabilities (dyslexia, dyscalculia, dysgraphia) []
    - ❒ Cerebral Palsy []
    - ❒ Speech and Language Difficulties []
    - ❒ Multiple Disabilities []
    - ❒ Autism []
    - ❒ Albinism []
    - ❒ Attention Deficit Hyperactivity Disorder []
    - ❒ Other (*Specify*)
15. The classroom had a sufficient source of electricity
    - ❒ Yes []
    - ❒ No []
16. The teacher utilized digital technologies during the lesson
    - ❒ Yes []
    - ❒ No []
17. Learners utilized digital technologies for learning during the lesson
    - ❒ Yes []
    - ❒ No []
18. The teacher used the following Digital Hardware Technologies to facilitate learning during the lesson (*Multiple answers are possible*)
    - ❒ Radio(s) []
    - ❒ Desktop Computer(s) []
    - ❒ Laptop Computer(s) []
    - ❒ Tablet(s) []
    - ❒ Printer(s) []
    - ❒ Photocopier Machine(s) []
    - ❒ Internet Access via LAN []
    - ❒ Internet Access via WIFI []
    - ❒ Smartphone(s) []
    - ❒ Group Hearing Aid System for Deaf Learners []
    - ❒ Television Monitor(s) []
    - ❒ Projector(s) []
    - ❒ White Board(s) []
    - ❒ Camera/Video Camera(s) []
    - ❒ Hearing Aid(s) []
    - ❒ Refreshable Braille Display(s) []
    - ❒ Thermoform Machine(s) []
    - ❒ Other (*Specify*)……
19. The teacher used the following Digital Software Technologies to facilitate learning during the lesson (*Multiple answers are possible*)
    - ❒ YouTube []
    - ❒ Facebook []

- ❒ Facebook Messenger []
- ❒ WhatsApp []
- ❒ Moodle []
- ❒ Google Meet []
- ❒ Google Classroom []
- ❒ Pinterest []
- ❒ Microsoft Word []
- ❒ Microsoft Excel []
- ❒ Microsoft PowerPoint []
- ❒ Microsoft Classroom []
- ❒ Talent LMS []
- ❒ Schoology []
- ❒ Dyknow []
- ❒ ClassDojo []
- ❒ Kahoot []
- ❒ Other (*Specify*) …….

20. Any other relevant observations (*Please describe here any other relevant observations that may not have been captured by this tool*) ……

THE END

Appendix IV: Internal Consistency Analysis for Application of DL Scale

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I select suitable digital resources for teaching and learning, considering the specific learner's needs.	27.24	28.19	0.53	0.44	0.839
I consider possible restrictions to the use or re-use of digital resources e.g., copyright, file type, technical requirements, legal provisions, accessibility).	27.45	28.42	0.51	0.43	0.841
I share digital resources with my colleagues online.	27.44	27.30	0.61	0.40	0.832
I use digital technologies to guide and support learners	27.37	28.18	0.59	0.41	0.834
I require learners to use digital technologies to interact among themselves in the learning environment.	27.81	27.11	0.55	0.54	0.837
I require learners to use digital technologies for self-assessment	28.15	26.53	0.55	0.57	0.837
I use digital technologies to enhance assessment strategies, e.g., using computer-based tests, classroom response systems and quizzes, games	27.98	26.23	0.61	0.43	0.831
I use digital technologies to record, compare and synthesize data on learner progress.	27.95	26.04	0.62	0.42	0.830
I use digital technology to provide feedback to learners and their parents/guardians	28.11	26.49	0.57	0.39	0.835

Appendix V: Internal Consistency Analysis for Self-Efficacy in DL Scale

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Successfully search for relevant digital information/content that I need	50.45	74.02	0.54	0.42	0.889
I retrieve digital information/content whenever I want	50.47	72.44	0.66	0.58	0.884
I organize digital information/content the way I want	50.60	73.57	0.62	0.48	0.886
I use the internet to reasonable extent in my professional communications	50.41	73.54	0.61	0.43	0.886
I use digital technologies in collaborative processes for learning	50.64	74.72	0.58	0.46	0.887
I use technology for co-construction and cocreation of learning resources and knowledge	50.71	74.15	0.60	0.45	0.886
I create digital content in different formats e.g., documents using office tools like Ms. word, Excel & PowerPoint	50.71	72.77	0.59	0.41	0.887
I create online documents such as google docs, google forms etc	51.50	73.43	0.50	0.33	0.891
I can share my own content with other online users	50.65	74.10	0.56	0.34	0.888
I secure digital information against unauthorised access	51.14	73.93	0.46	0.27	0.893
I enable learners to understand risks and threats in digital environments e.g., identity theft, fraud, stalking, phishing) and how to react appropriately	50.83	72.24	0.58	0.54	0.887
I protect learners against threats to their well-being in online environments e.g., cyberbullying	50.76	72.33	0.59	0.53	0.887
I solve teaching and learning challenges using digital technologies	50.95	74.81	0.48	0.35	0.891
I use digital technologies to create innovative teaching approaches	50.68	74.26	0.62	0.43	0.886
I am up to date with digital evolution	51.04	73.51	0.58	0.37	0.887

Appendix VI: PCA Extractions Based on Eigenvalue (λ >1)

Table(a): Total Variance Explained by Components in Application of DL Scale.

Component	Eigenvalues	% of Variance	Cumulative %
1	4.14	46.01	46.01
2	1.27	14.14	60.15
3	0.86	9.59	69.74
4	0.65	7.23	76.96
5	0.55	6.08	83.05
6	0.45	5.03	88.08
7	0.43	4.76	92.84
8	0.38	4.20	97.04
9	0.27	2.96	100.00

Table (b): Total Variance Explained by Components in Self-efficacy in DL Scale.

Component	Eigenvalues	% of Variance	Cumulative %
1	6.22	41.50	41.50
2	1.27	8.48	49.98
3	1.01	6.72	56.70
4	0.86	5.74	62.44
5	0.74	4.92	67.35
6	0.70	4.69	72.05
7	0.65	4.36	76.40
8	0.61	4.09	80.49
9	0.55	3.68	84.17
10	0.53	3.51	87.68
11	0.46	3.04	90.72
12	0.44	2.92	93.64
13	0.36	2.42	96.06
14	0.32	2.14	98.20
15	0.27	1.80	100.00

Table (c): Total Variance Explained by Components in DL Challenges Scale

Component	Eigenvalues	% of Variance	Cumulative %
1	3.31	25.47	25.47
2	2.23	17.12	42.60
3	1.48	11.35	53.94
4	0.98	7.54	61.48
5	0.87	6.71	68.19
6	0.71	5.44	73.63
7	0.67	5.16	78.79
8	0.62	4.76	83.55
9	0.59	4.56	88.11
10	0.47	3.58	91.69
11	0.41	3.15	94.84
12	0.35	2.72	97.57
13	0.32	2.43	100.00

Extraction Method: Principal Component Analysis (PCA).

Appendix VII: Factor Loading for Components in Application of DL Scale

	Component 1	Component 2
I select suitable digital resources for teaching and learning, considering the specific learner's needs.	0.656	-0.451
I consider possible restrictions to the use or re-use of digital resources (e.g., copyright, file type, technical requirements, legal provisions, accessibility)..	0.628	-0.564
I share digital resources with my colleagues online.	0.715	-0.148
I use digital technologies to guide and support learners	0.702	-0.131
I require learners to use digital technologies to interact among themselves in the learning environment.	0.648	0.558
I require learners to use digital technologies for self-assessment	0.649	0.62
I use digital technologies to enhance assessment strategies, e.g., using computer-based tests, classroom response systems and quizzes, games	0.705	0.108
I use digital technologies to record, compare and synthesize data on learner progress.	0.718	0.056
I use digital technology to provide feedback to learners and their parents/guardians	0.677	-0.048

Extraction Method: Principal Component Analysis.

Appendix VIII: Labels for Components in Application of DL Scale

Component I: Selection and Use of Digital Resources

- I select suitable digital resources for teaching and learning, considering the specific learning context and learning objective.
- I consider restrictions to the use or re-use of digital resources (e.g., copyright, file type, technical requirements, legal provisions, accessibility).
- I share digital resources with my colleagues online.

Component II: Integration of Digital Technologies in Teaching and Assessment

- I use digital technologies to guide and support learners.
- I require learners to use digital technologies to interact among themselves in the learning environment.
- I require learners to use digital technologies for self-assessment.
- I use digital technologies to enhance assessment strategies, e.g., using computer-based tests, classroom response systems, quizzes, games.
- I use digital technologies to record, compare, and synthesize data on learner progress.
- I use digital technology to provide feedback to learners and their parents/guardians.

Appendix IX: Factor Loading for Components in Self-Efficacy Scale

	Component 1	Component 2	Component 3
Successfully search for relevant digital information/content that I need	0.628	-0.284	-0.406
I retrieve digital information/content whenever I want	0.735	-0.287	-0.342
I organize digital information/content the way I want	0.689	-0.274	-0.201
I use the internet to reasonable extent in my professional communications	0.679	-0.134	-0.199
I use digital technologies in collaborative processes for learning	0.657	-0.348	0.074
I use technology for co-construction and cocreation of learning resources and knowledge	0.689	-0.13	0.068
I create digital content in different formats e.g., documents using office tools like Ms. word, Excel & PowerPoint	0.661	0.243	-0.039
I create online documents such as google docs, google forms etc	0.575	0.252	0.354
I can share my own content with other online users	0.611	0.13	0.064
I secure digital information against unauthorised access	0.527	0.379	-0.019
I enable learners to understand risks and threats in digital environments (e.g., identity theft, fraud, stalking, phishing) and how to react appropriately	0.637	0.534	-0.192
I protect learners against threats to their well-being in online environments e.g., cyberbullying	0.647	0.473	-0.117
I solve teaching and learning challenges using digital technologies	0.569	-0.276	0.548
I use digital technologies to create innovative teaching approaches	0.684	-0.1	0.241
ɔ date with digital evolution	0.643	-0.028	0.309

Extraction Method: Principal Component Analysis.

Appendix X: Labels for Components in Self-Efficacy in DL Scale

Component I: Information Retrieval and Utilization

- I successfully search for relevant digital information/content that I need.
- I retrieve digital information/content whenever I want.
- I organize digital information/content the way I want.
- I use the internet to a reasonable extent in my professional communications.

Component II: Digital Content Creation and Collaboration

- I use digital technologies in collaborative processes for learning.
- I use technology for co-construction and co-creation of learning resources and knowledge.
- I create digital content in different formats, e.g., documents using office tools like MS Word, Excel & PowerPoint.
- I create online documents such as Google Docs, Google Forms, etc.
- I can share my own content with other online users.

Component III: Digital Safety and Innovation

- I secure digital information against unauthorized access.
- I enable learners to understand risks and threats in digital environments (e.g., identity theft, fraud, stalking, phishing) and how to react appropriately.
- I protect learners against threats to their well-being in online environments, e.g., cyberbullying.
- I solve teaching and learning problems using digital technologies.
- I use digital technologies to create innovative teaching approaches.
- I am up to date with digital evolution.

Appendix XI: Factor Loading for Components in DL Challenges Scale

	Component 1	Component 2	Component 3
I know how to use digital technologies for personal purposes	0.133	0.647	0.017
I have the technical skills that I need to utilize digital technologies to facilitate learning	0.189	0.694	-0.113
All the required digital technologies are available in classes that I work in	0.740	0.224	0.119
I am recquired to use digital technologies to facilitate learning	-0.438	0.588	0.303
The curriculum prescribes use/application of digital technologies in class	-0.437	0.587	0.341
I can afford digital technologies for use to teach/facilitate learning.	0.739	0.347	-0.047
I have internet access in all classes that I teach at school.	0.835	0.119	0.027
I receive satisfactory in-service training on digital competencies	0.560	0.338	-0.004
I prefer analogue to digital technology when facilitating learning	0.429	-0.270	0.439
Digital competence is for the digital generation/natives	0.432	-0.151	0.556
I would like to receive more in-service training on digital competencies	-0.449	0.376	0.156
Use of digital technologies is too difficult for me	0.094	-0.303	0.713
Digital technologies are expensive	-0.437	0.081	0.451

Extraction Method: Principal Component Analysis.

Appendix XII: Labels for Components in DL Challenges Scale

Factor 1: Digital Literacy and Access

- I know how to use digital technologies for personal purposes.
- I have the technical skills that I need to utilize digital technologies to facilitate learning.
- The digital technologies are available in the class(es) I work in.
- I am required to use digital technologies.
- The curriculum prescribes the use/application of digital technologies in class.
- I can afford digital technologies.
- I have internet access.

Factor 2: In-Service Training and Competence

- I receive satisfactory in-service training on digital competencies.
- I would like to receive more in-service training on digital competencies.
- Digital competence is for the digital generation/natives.
- It is expensive to acquire digital competencies.

Factor 3: Preference and Difficulty

- I prefer analogue to digital technology when facilitating learning.
- Use of digital technologies is too difficult for me.
- Digital technologies are expensive.

Appendix XIII: Decision of the Research Ethics Committee

PEDAGOGICKÁ FAKULTA
UNIVERZITA KARLOVA

DECISION OF THE RESEARCH ETHICS COMMITTEE

Dear Martin Mwongela Kavua, MA.

The Research Ethics Committee of Faculty of Education, Charles University found that the study carried out within the project ***Digitální gramotnost mezi učiteli žáků se zdravotním postižením na základních školách v Keni a ČR.*** met the requirements for ethical research practices.

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Prague 26/07/2022

doc. RNDr. Antonín Jančařík, Ph.D.

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Appendix XIV: NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **948838**

Date of Issue: **06/December/2022**

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