

Integration of ICT in Schools: Context-Aware ICT Appropriation (CAIA) Model

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Abstract: The integration of Information and Communication Technology (ICT) into South African schools is problematic due to access inequalities. This study investigated the dynamics of access to and use of ICT in the context of the COVID-19 pandemic. The qualitative study used a phenomenological approach based on a posthuman philosophical framework and used the Actor-network theory (ANT) as a methodological approach to educational technology. Van Dijk's cumulative access model, combined with Jansen's dimensions of digital inequality, was employed as a theoretical and conceptual framework. ANT was used to identify the various actors involved in the process, to examine their interactions, to understand the use of technology, and to assess their integration into educational practices. The study confirms that access does not follow a simplistic linear progression of continuous phases and proposes the *Context-Aware ICT Appropriation* (CAIA) model that encompasses a broader contextual approach. This research supports the need for a more complex and nuanced understanding of the multifaceted concept of access to ICT, which more accurately reflects how teachers actively interact with technology in an increasingly technology-driven society. The study has contributed to the theoretical and practical aspects of the field and laid the foundations for future research. It is essential to assess the practical effectiveness and capacity of the CAIA model to overcome the limitations of isolated technology interventions. The researcher advocates for future studies to evaluate the applicability and efficacy of the proposed CAIA model in the real world.

Keywords: Information and communication technology (ICT), ICT access, ICT readiness, ICT integration

1. Introduction

Integration of Information and Communication Technology (ICT) in South African schools is problematic due to inequalities in access to ICT. This study explored access to and use of ICT in the context of the COVID-19 pandemic. Although the literature review highlighted an urgent need for improved access to ICT, there is a notable gap in research that sheds light on the complexities of access to ICT and how it can support or hinder the use of ICT for educational purposes. To address this research gap, this study sought to develop a sound theoretical understanding of the dynamics behind access to and use of ICT in schools.

This qualitative study employed a phenomenological approach guided by a posthumanist philosophical framework to explore the interplay between access to and use of ICT. Actor-network theory (ANT) was used as a methodological approach and Van Dijk's cumulative model of access, combined with Jansen's dimensions of digital inequality, was used as the theoretical and conceptual framework.

The findings of this study challenge the notion that access to ICT follows a linear path toward usage. Instead, successful integration of ICT requires a more networked and relational perspective on access, highlighting the significance of contexts that require, motivate and empower teachers to use ICT. To this end, the study introduces an original contribution to the existing body of knowledge - the Context-Aware ICT Appropriation (CAIA) model.

2. Problem Statement

The current body of literature lacks a comprehensive grasp of teachers' access to and use of ICT (Soomro et al., 2018). While inequalities in access to and use of ICT are an area of concern, theoretical attempts to understand the dynamics shaping these inequalities are scarce (Ghobadi and Ghobadi, 2015). In South Africa, empirical data are scarce regarding access to and use of ICT in schools, particularly from the viewpoint of teachers (Mwapwele et al., 2019).

Variations in socio-economic, geographical, and educational contexts significantly affect access to and use of ICT for educational purposes in South Africa. This reality posed a formidable challenge to the delivery of education during the COVID-19 pandemic (Padmanabhanunni and Pretorius, 2023). As a result, only a small number of

well-resourced schools transitioned to technology-mediated remote teaching, while most schools experienced little to no educational activity (Dube, 2020). Considering the persisting disparities in ICT access within the South African education system, a focus on ensuring equitable and sustainable access is both justifiable and necessary (Czerniewicz and Brown, 2005).

3. Literature Review

A critical examination of the current body of knowledge on the topic serves as the cornerstone for the study. The literature review homes in on principal themes and interrelated subtopics within the research field and constructs a theoretical and conceptual framework for the study.

3.1 COVID-19 Pandemic: Educational Disruption and Response

The global COVID-19 pandemic represented the most extensive disruption to education ever (Santandreu Calonge et al., 2022; Dorfsman and Horenczyk, 2022; Crompton et al., 2021). While the pandemic halted traditional classroom-based education, 21st-century technology provided a substantive way for schools to remain operational (Arnett, 2021; Fuchs, 2022). Because of the swift implementation of technology, the term *emergency remote teaching* (ERT) emerged to describe and reflect the urgency of surviving in a time of crisis (Hodges, Moore and Lockee, 2020; Bozkurt and Sharma, 2020).

The South African government implemented various measures to ensure the continuity of teaching and learning during the pandemic. The success of these initiatives was, however, significantly shaped by the diverse socio-economic, geographical, and educational contexts existing throughout the country. For example, many government schools are located in underserved communities and have limited access to technology and the internet. Private schools, on the other hand, generally have more resources and better technological infrastructure and were able to adapt to online learning more smoothly. However, the accessibility of private schools is limited to those who can afford tuition, creating disparities in educational access. Schools located in more affluent communities often had greater financial resources, which allowed them to invest in technology, infrastructure, and additional support for students.

Learners in poor communities lacked access to technology and educational resources which made it difficult for them to keep up with their studies during lockdowns. Urban schools in South Africa's major cities often had better access to technology and internet connectivity, while geographically isolated rural schools often had limited access to the internet, electricity, and technology devices. In the best-case scenario, a very small number of well-resourced schools managed to transition smoothly to remote teaching (Dube, 2020; Landa, Zhou and Marongwe, 2021; Mbhiza, 2021). In the worst-case situations, however, teaching and learning essentially came to a standstill due to the absence of the necessary digital infrastructure (Lie et al., 2020; Hennessy et al., 2021; Moyo et al., 2022), placing numerous students at risk of falling behind (Dube, 2020).

3.2 ICT Access

While ICT enables remote teaching and learning capabilities (Tauson and Stannard, 2018), technology-mediated teaching is only viable in educational settings where there is appropriate access to ICT (Padmanabhanunni and Pretorius, 2023). Given the skewed access to resources and the fundamental inequalities that continue to characterise South African society, a focus on ICT access is understandable.

3.2.1 Access and use

Access to and use of ICT are interdependent constructs. ICT only has meaning or value in relation to an implicit or explicit purpose (Sadeck, Chigona and Cronjé, 2020). In the context of education, access thus refers to teachers' willingness, ability, and need to actually use ICT for educational purposes (Czerniewicz and Brown, 2005).

3.2.2 Theories of access

The concept and theories of access to ICT have in recent years evolved beyond a focus on primarily physical access. Researchers have started considering the conditions or criteria for access and broadened the concept by including additional dimensions, components, and resources (Czerniewicz and Brown, 2005).

The following models and frameworks, summarised in Table 1, offer more nuanced perspectives on the dimensions of access to ICT:

- Van Dijk (2005), focusing on exclusion, argues that unequal access to ICT perpetuates existing social inequalities and leads to further marginalization of groups;
- Bridges (2001), on the other hand, contends that access to ICT can promote social inclusion by providing opportunities for participation and engagement in society;
- Kvasny and Truex's (2001) critical theory framework scrutinizes the power structures, ideologies, and systemic inequalities that shape ICT access and use;
- Warschauer's (2003) digital divide theory explores the disparities in access to and use of ICT, particularly between different socio-economic groups and regions.

Table 1: Theories of ICT access

Van Dijk (2005) Social Exclusion Theory	Bridges (2001) Social Inclusion Framework	Kvasny and Truex (2001) Critical Theory Framework	Warschauer (2003) Digital Divide Theory
Emphasizes the importance of addressing not just physical access to technology but also the skills and resources necessary to utilize it effectively.	Highlights the potential of ICT to empower marginalized groups and foster social cohesion by facilitating communication, collaboration, and access to information.	Critique dominant discourses surrounding technology and argue for a deeper understanding of how power dynamics influence access to and use of ICT.	Emphasizes the need for policies and interventions to bridge the digital divide, addressing issues such as infrastructure, affordability, and digital literacy.
Dimensions of Access			
Mental access - motivation to use ICT.	Participation - engaging in activities facilitated by ICT, e.g. communication.	Power dynamics - distribution of power, influence, and control within the context of ICT access.	Global disparities - differences in ICT access and usage between countries and regions.
Physical access - ICT infrastructure and devices.	Engagement - Involvement in online communities and social networks.	Ideological constructs - dominant ideologies and discourses surrounding technology.	Socioeconomic disparities - inequalities in ICT access within societies.
Skills access - knowledge and competencies to use ICT.	Equity - fair and equal access to and benefit from ICT.	Structural inequalities - systemic barriers and inequalities that limit access to ICT.	Cultural and linguistic factors - influence of cultural values, language barriers, and digital content availability.
Usage access – purposeful use of ICT, e.g. education.	Integration - incorporation of ICT, e.g. education.	Resistance and agency - oppressive structures and the potential for marginalized groups to assert their agency.	Policy and intervention - government policies, programmes, and interventions.
Comments			
Conventional hierarchical or linear view of access and the limited focus on human agency is a concern.	Too focused at the macro level and does not consider the specifics of human agency and aspects of individual access.	Suggestion that key concepts should be 'cross-mapped' informs a more relational approach.	The four categories for social inclusion – physical, digital, human and social – offer an excellent underpinning.

While Van Dijk's model has been instrumental in exploring and understanding the complexities of ICT access, alternative theories of access to ICT have emerged, challenging the conventional hierarchical view of access. While these theories acknowledge that material access is a primary requirement, they view the appropriation of ICT as a complex and iterative process, encompassing multiple dimensions of access experienced simultaneously. Because none of these models encompass the range of resources required for access to ICT in an educational context, Czerniewicz and Brown (2005) combined, simplified and enhanced the existing models to develop a more comprehensive framework for ICT access. This model of access, illustrated in Figure 1, describes what people use, need and draw on in order to gain access to specific ICT uses in terms of four kinds of resources namely technology, personal agency, contextual and online content.

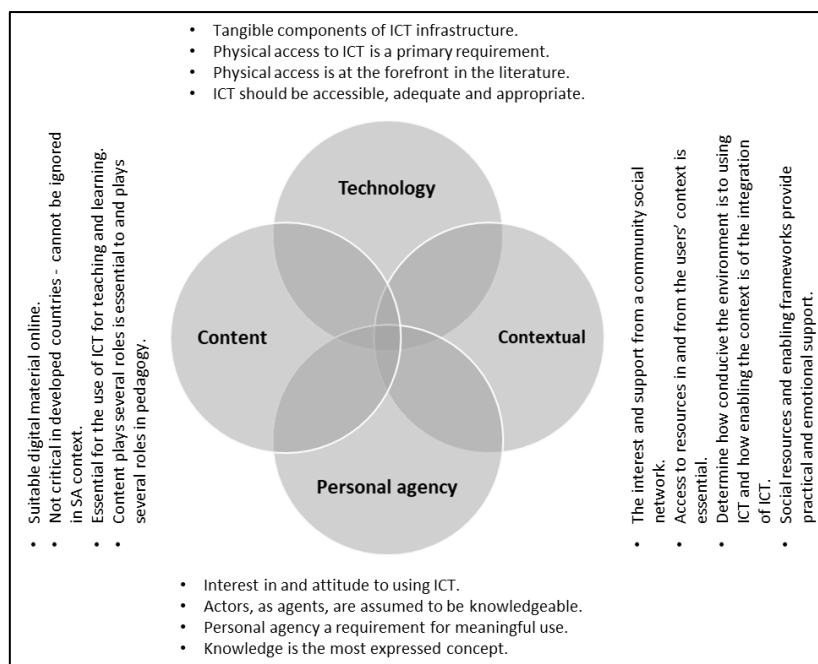


Figure 1: Access to ICT as interrelated resources (Adapted from Czerniewicz and Brown, 2005)

3.3 ICT Integration

ICT integration in education is a complex process, culminating in the actual use of ICT to enhance the teaching and learning experience (Sadeck, Chigona and Cronjé, 2020). ICT integration is discussed in more detail with reference to the TPACK model and ICT readiness.

3.3.1 TPACK

The TPACK (Technological Pedagogical Content Knowledge) framework (Mishra and Koehler, 2006) outlines the various forms of knowledge that teachers need to successfully integrate technology into their teaching practices. The most well-known aspect of this framework is its TPACK diagram, which illustrates three interconnected circles representing Technological Knowledge (TK), Pedagogical Knowledge (PK) and Content Knowledge (CK).

This well-established framework has recently been enhanced by introducing a fourth knowledge domain, with the outer dotted circle now labelled Contextual Knowledge (XK). As depicted in Figure 2 (Mishra, 2019), Contextual Knowledge pertains to a teacher's understanding and awareness of available technology as well as the broader context within which they operate, such as the school, district, provincial, or national level.

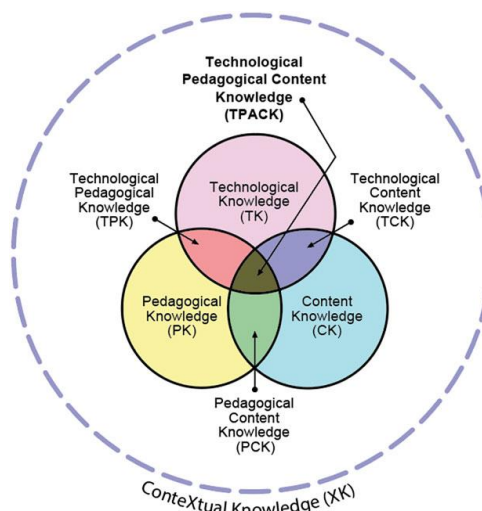


Figure 2: Revised version of the TPACK (Mishra, 2019) (Reproduced by permission of the publisher, © 2012 by tpack.org)

The adapted framework highlights the critical importance of organisational, situational, and broader contextual constraints. The success of teachers' ICT integration efforts depends not as much on their technological, pedagogical, and content knowledge, but rather on their knowledge of the context (Mishra, 2019).

3.3.2 ICT readiness

ICT readiness or digital maturity is a multifaceted concept denoting a school's capacity to successfully integrate ICT in teaching and learning (Veldsman, van Greunen and Botha, 2020). The concept is becoming more and more significant within the educational system, due to the increasing importance of ICT (Van Greunen, Kativu and Veldsman, 2021). In practice, digital maturity levels encompass a spectrum, ranging from having no access to ICT to being technologically, psychologically and pedagogically ready to conduct digital teaching and learning.

The Department of Science and Innovation (DSI) recently developed a decision support tool that can be used to assess schools' e-readiness levels before any ICT-based intervention is deployed (Van Greunen, Kativu and Veldsman, 2021). This tool evaluates e-readiness using indicators organised in five areas and five levels of maturity (Table 2).

Table 2: Digital maturity tool for schools (Van Greunen, Kativu and Veldsman, 2021)

Assessment area	Level 1 Digitally unaware	Level 2 Digital beginner	Level 3 Digitally competent	Level 4 Digitally advanced	Level 5 Digitally mature
Leadership and vision	Limited, if any awareness of using ICT in teaching practices.	Some awareness of using ICT in teaching, but not yet in practice.	Use ICT in teaching practices.	ICT integrated into teaching practices.	ICT systems integrated to strategically position the school.
ICT in the curriculum					
Development of digital competencies	ICT is used only in some classrooms.	Limited staff use ICT in teaching and learning.	Staff develop their digital competencies and digital content.	Staff develop their own content and use ICT for advanced teaching styles.	ICT is used extensively in teaching and learning.
School ICT culture		ICT in some classrooms.	ICT in most classrooms.	ICT in most classrooms.	Digital content repository.
School and ICT infrastructure					Access via own devices in all classrooms.

The DSI tasked the Nelson Mandela University's Centre for Community Technologies (CCT) in South Africa with the refinement, testing, and enhancement of the manual tool into a digital e-Readiness Tool (Van Greunen, Kativu and Veldsman, 2021). Based on the averages the majority of schools ended up at Level 3 which indicates an awareness of the role of digital technologies (Figure 3).

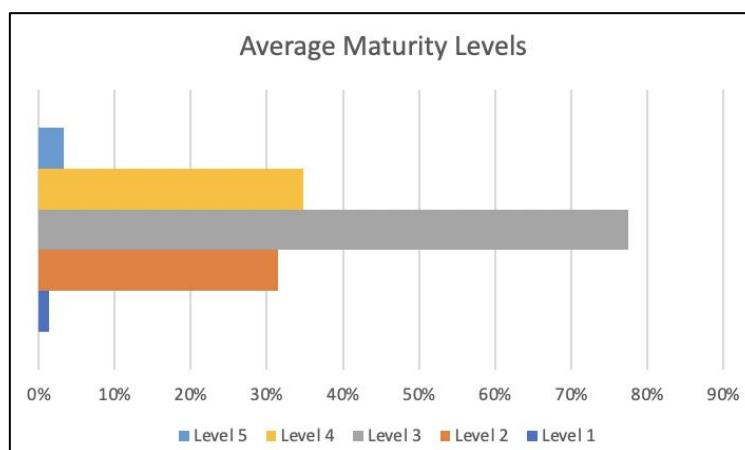


Figure 3: Average maturity levels across 5199 schools

To improve the integration of digital technologies into the education sector requires new and improved ways of doing things.

3.4 Theoretical and Conceptual Framework

Van Dijk's cumulative model of access in conjunction with Jansen's dimensions of digital inequality offered a valuable conceptual framework (Figure 4) for exploring the dimensions and dynamics of access to ICT in the South African educational context.

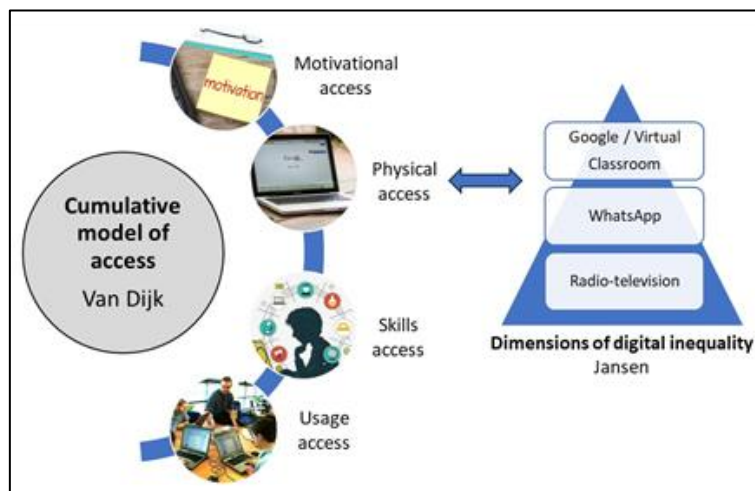


Figure 4: Theoretical and Conceptual framework (Author's construct)

Van Dijk delineates four access types, namely motivational, physical, skills and usage access, that occur in sequential stages each reliant on the others. This will lead to skills access and only then is access to full usage obtained.

1. Motivational access

Motivational access refers to the preparedness and eagerness to acquire and engage with digital technology. Despite its pivotal significance, motivation is often neglected or underestimated in real-world applications (Van Dijk 2012). Motivation can be classified into two categories: intrinsic motivation, which originates from within, and extrinsic motivation, which is externally driven (Soomro et al., 2018).

2. Physical access

Physical access, i.e. the presence of the necessary devices and resources, serves as a fundamental requirement. As a result, physical access is a significant focal point in all conversations regarding access, as indicated in the current literature (Peters et al., 2020; Crompton et al., 2021).

Jansen (2020) identified three dimensions of digital inequality (Figure 4) associated with physical or material access during the COVID-19 pandemic, namely:

- Google Classroom,
- WhatsApp, and
- Radio-Television groups.

The shift from in-person to online remote teaching was a relatively seamless process for the small number of well-equipped Google Classroom or "Virtual Classroom" (to include the use of alternative communication platforms such as Moodle and Microsoft Teams) schools. Regrettably only about 6% of all learners engaged in online remote learning during the pandemic (StatsSA, 2020). In practice, most teachers and learners made use of WhatsApp for educational communication. This preference was primarily due to a higher percentage of households using mobile phones to access the internet compared to other devices. Although WhatsApp enabled teachers and learners to engage in remote communication, the platform's educational functionality remained rudimentary, and the learning experience was adversely affected by challenges related to device availability, data costs, and inconsistent internet connections. Unfortunately, most South African learners had no alternative but to depend on educational radio and TV broadcasts for their remote learning needs. Because of the

constraints of these broadcast platforms, the lockdown resulted in minimal, if any, educational advantages for most of these learners.

3. Skills access

Skills access refers to the ability to use digital technology and consists of three levels, namely operational, informational, and strategic skills (Van Dijk, 2005). In brief, operational ICT skills are the foundational skills required for routine day-to-day use of digital tools and software applications. Informational ICT skills are the higher levels of competency in managing and manipulating digital information. Strategic ICT skills represent the highest level of digital competence and involve understanding the broader impact of technology on an organization or society and aligning technology with long-term goals and objectives.

4. Usage access

Usage access to ICT denotes the ability and opportunity to effectively employ ICT tools and resources across various domains like education, business, or personal use. It signifies the deliberate decision to engage with digital technology and assumes that individuals exercise this choice freely, influenced by factors such as need, opportunity, responsibility, availability, or effort.

Within an educational context, having usage access to ICT empowers teachers to integrate technology into their teaching practices, leading to improved teaching and learning experiences. It equips teachers with the capacity to use multimedia materials, interactive learning platforms, educational applications, and online resources to present information in engaging and interactive formats.

3.5 Critical Reflection

The relationship between access to and use of ICT in an educational context is more complex than presumed (Soomro et al., 2018). Physical access may serve as a fundamental requirement, but it does not by default lead to the actual use (Chisango, 2021). ICT integration in educational settings rather represents a multifaceted process that necessitates a more interconnected, relational, and contextualised perspective of access to and use of ICT.

4. Research Design and Method

This paper follows and expands on a study reported in an earlier paper: ‘The Dynamics of Access to ICT and Technology Practices of Secondary School Teachers’ (Kennedy and Cronjé, 2023). This study applied a phenomenological orientation, underpinned by an interpretivist philosophy and ANT (Tatnall, 2019; Rowan and Bigum, 2003), to explore the patterns of technology-mediated interaction between teachers and learners. An interpretative phenomenological approach was deemed appropriate as it allows the researcher to get a thorough understanding of the phenomenon by exploring the lived experiences and perceptions of participants (Cohen, Manion and Morrison., 2007; Pietkiewicz and Smith, 2012). ANT was applied as a theoretical lens as it emphasizes the agency of both human (teachers and learners) and non-human actors (technology) in the process of ICT appropriation.

The exploratory study adopted a qualitative survey design to investigate teaching with technology practices before, during, and after the COVID-19 pandemic. An online survey, created using Google Forms, was used to explore secondary school teachers’ lived experiences during the COVID-19 pandemic. The survey consisted of six demographic questions, twelve open-ended questions, ten Likert-scale items, one select-all-that-apply item, and three multiple-choice items. A 4-point scale was used for the Likert-scale items (0=Low to 3=High). In terms of the content of the survey, the questions focused on teachers’ experience of the transition to ERT, technological-pedagogical knowledge, and access to and use of ICT in their teaching practice. The survey included a consent statement, and responses were submitted anonymously.

Purposive sampling enabled the researcher to carefully select specific participants known for their use of educational technology and their potential to offer valuable and dependable data (Saunders, Lewis and Thornhill., 2012; Moser and Korstjens, 2018; Taherdoost, 2016). A total of 22 teachers from government schools responded to the survey. The sample was diverse in terms of gender, age, years of experience of the teachers, and socio-economic status of the schools.

This design and method allowed the researcher to gain insight into a complex phenomenon by revealing concealed experiences within a specific social setting (Merriam, 1998; Denzin and Lincoln, 2011; Creswell and Creswell, 2018). The researcher applied inductive reasoning to search for causal patterns and develop explanations for those patterns (Maxwell 2008).

4.1 Posthumanism

The term "post-human" denotes an understanding of the interrelationship between humans and their technological surroundings, along with the ethical considerations that accompany it (Wolhuter and Jacobs, 2021). Posthumanism introduces fresh perspectives on perceiving humans, including teachers and learners, as not uniquely significant but interwoven with technology. Employing a post-humanist perspective in education prompts us to reevaluate teaching methods, the generation of knowledge, and its distribution, consequently introducing innovative teaching approaches that challenge traditional thinking and generate new knowledge (Blaikie, Daigle and Vasseur, 2020).

e-Learning constitutes a socio-technical system involving an intricate interplay between human and technological elements (Mlitwa, 2007). Consequently, research in the field of educational technology should adopt a socio-technical approach to explore the activities and interactions among teachers, learners, and technology (Tatnall, 2019). This study employs posthumanism as a broad philosophical perspective and uses Actor-Network Theory (ANT) as its methodological approach to educational technology.

4.2 Actor-Network Theory

ANT provides a useful framework for studying technology-mediated teaching practices because it emphasizes the role of both human and non-human actors (Rowan and Bigum, 2003; Latour, 2005; Law, 2009). For this reason, ANT can be applied as a theoretical lens to critically explore the dynamics of access to and use of ICT in an educational context.

ANT maintains that social organisations are not made up solely of people and does not favour the human over material matters or technology (Rowan and Bigum, 2003; Tatnall, 2019). ANT, therefore, allows a researcher to analyse a complex social setting in which both human and non-human are seen as a dynamically interacting network within which each part influences the other parts (Thomas and De Villiers, 2002; Matthews, 2021).

In this study, ANT was employed to explore technology-mediated teaching practices and to analyse the interactions between teachers, learners, and technology in the context of the COVID-19 pandemic. ANT was used to identify the various actors involved in the process, examine their interactions, understand technology usage, and assess its integration into teaching practices.

5. Key Findings

The qualitative research design allowed the researcher to gain a thorough and profound insight into a complex phenomenon by revealing concealed experiences within a specific social setting (Merriam, 1998; Denzin and Lincoln, 2011; Creswell and Creswell, 2018). Since qualitative findings do not lend themselves easily to generalisation owing to the absence of statistical analysis (Hammersley, 2007; Merriam, 2009), this study aimed to uncover, explore, and explain recurring patterns instead. The findings of the study highlighted the complex relationship between access to and use of ICT and the critical importance of context.

5.1 Dynamics of Access to and use of ICT

Before the pandemic, the use of ICT was optional, and teachers mainly used it to assist in or mimic conventional classroom methods. Nevertheless, the COVID-19 pandemic mandated that teachers use ICT for remote instruction, primarily driven by the need to adhere to social distancing measures. Many stakeholders in the field of education had anticipated that the technological advancements brought about by the COVID-19 pandemic would persist into the period after the pandemic. Yet, the outcomes of this investigation suggest that the connection between teachers' access to and their actual use of ICT is more complex.

The findings of this study revealed that during the pandemic, teachers experienced enhanced physical access to ICT and developed a more favourable view and deeper comprehension of the advantages of ICT in education. Consequently, some teachers began to incorporate innovative technology-driven teaching methods. Regrettably, when schools resumed their standard operations, most of the participants in this study predominantly reverted to conventional teaching approaches. The findings suggest that the boost in intrinsic motivation to use ICT was a transitory phenomenon. This suggests that motivation is not an inherent outcome of having physical access or skills but is a separate element that inspires teachers to actively explore and employ ICT. Motivational access to ICT signifies that teachers recognise its advantages and possess the necessary pedagogical knowledge and opportunities to integrate it into their teaching practices effectively (Kennedy and Cronjé, 2023).

In summary, the findings from this study propose that access does not follow a simple linear progression of consecutive stages. Physical access may serve as a fundamental requirement, but it does not inherently result in the sustained use of technology. The integration of technology into teaching and learning represents a multifaceted process that necessitates a more interconnected, relational perspective of access within educational settings, one that motivates and empowers teachers to use ICT in their teaching methods (Kennedy and Cronjé, 2023).

5.2 Critical Importance of CONTEXT

This study highlights the critical importance of CONTEXT in the dynamics of access to and use of ICT in schools. Existing studies have typically been localised case studies, primarily concentrating on technical aspects, overlooking the broader contextual factors of ICT integration. The theoretical constructs reviewed and employed all acknowledge and incorporate CONTEXT as a key variable in the relationship between access and use.

- Access to interrelated resources

This model describes what people use, need and draw on in order to acquire access to and use ICT in terms of different resources namely technology resources; resources for personal agency; *contextual* resources; and online content resources (Czerniewicz and Brown, 2005). The framework is based on the notions that (1) ICT is not used in a vacuum but is shaped by the social and cultural *context* in which it is used and (2) a binary view of ICT use for educational purposes provides an *uncontextualised* perspective.

- Digital inequality

ICT integration in SA is embedded in a systemically different *context* to that in developed countries (Sadeck, Chigona and Cronjé, 2020). In South Africa, diverse social and educational *contexts* significantly influenced access to and use of ICT during the pandemic. Jansen's dimensions of digital inequality add a South African *contextual* element to Van Dijk's cumulative model of access.

- Digital maturity

The digital maturity model recognises the need to *contextualise* both the internal and external environments in which schools operate. The majority of South African schools have not yet reached a stage where ICT is deeply ingrained in their school leadership and vision (Policy Brief, 2018; Van Greunen, Kativu and Veldsman, 2021).

- Revised TPACK model

The revised TPACK model provides for *Contextual* Knowledge (XK) to refer to a teacher's awareness of available technologies, and knowledge of the school, district, provincial, or national policies they operate within. Contextual knowledge is of critical importance, and a lack of it limits the effectiveness and success of a teacher's attempts at technology integration.

- ANT as theoretical lens

Various *contexts* and factors promoted or hindered teachers' appropriation of ICT. This study applied Actor-Network Theory (ANT) as a theoretical lens to explore the complex human and non-human actors. The analysis, interpretation, and reporting of the findings were guided by the Actor-Network Diagram as illustrated in Figure 5. The diagram was designed to identify the main *contexts* and actors in the network (Table 3), trace how each actor is linked to other actors, and illustrate the relationships and interactions between the human and non-human actors.

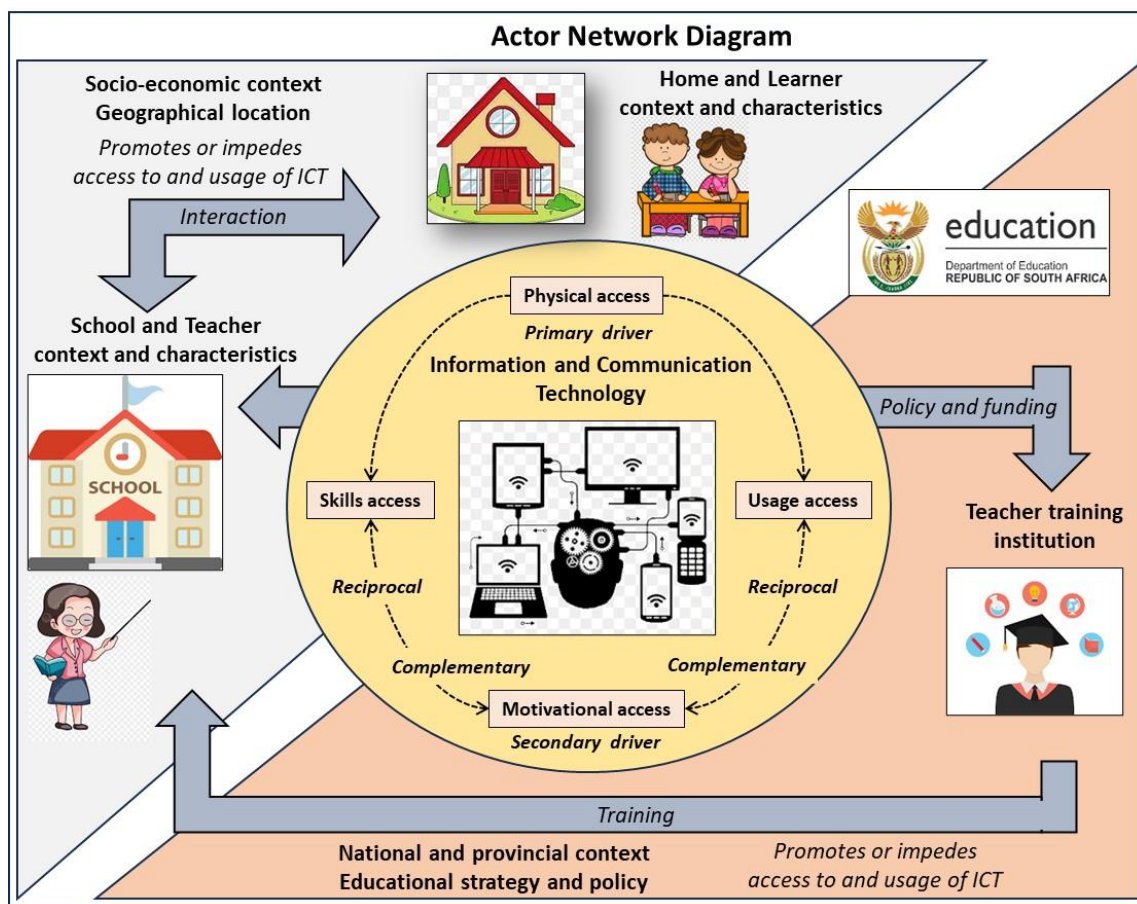


Figure 5: Actor-network diagram (author's construct)

Table 3: Actors in the network

Human actors	Non-human actors
School management	School environment
Technical support staff	
Teachers	
Parents	Home environment
Learners	
	Education department
	Teacher training institutions
	Information and Communication Technology
	Socio-economic context
	Geographical location

Despite the critical importance of *context*, South African education policy narrowly focuses on physical access to ICT which results in unrealistic expectations about ICT initiatives in schools. Just providing digital devices to schools, teachers, and learners is not the complete solution. Policymakers should adopt a more comprehensive and context-aware approach that considers all the factors and actors influencing ICT access and their interconnectedness. Building on Van Dijk's cumulative model of access, this study proposes an ICT appropriation model that considers and incorporates a broader contextual approach.

6. Context-Aware ICT Appropriation Model

The Context-Aware ICT Appropriation model (CAIA), illustrated in Figure 6, expands on Van Dijk's cumulative model of access by incorporating (1) the areas and associated elements of the ICT Readiness tool and (2) contexts and contextual factors identified in the ANT diagram.

The CAIA (*pronounced as KAH-ya*) model adds a unique and culturally relevant dimension to the model. The Zulu word "kaya" has significance in various African languages and cultures, often referring to a homestead or village. Depending on the specific context, it can symbolize community, belonging, and a sense of place. The term "kaya" conveys the idea of a sustainable and community-based approach to ICT implementation in schools. It implies that the CAIA model is not just a theoretical framework but also deeply rooted in the local context and culture, emphasizing the importance of community and shared knowledge in the implementation process.

The model's name thus effectively conveys its emphasis on context awareness within ICT access. It underscores the importance of adapting to various contextual factors when dealing with ICT, and its acronym, CAIA, offers a succinct reference for discussions and documentation. This suggests that the model is attuned to users' specific needs and circumstances, a valuable feature in the domain of access to and use of ICT. Overall, CAIA is a robust choice for a model emphasising context awareness in ICT access.

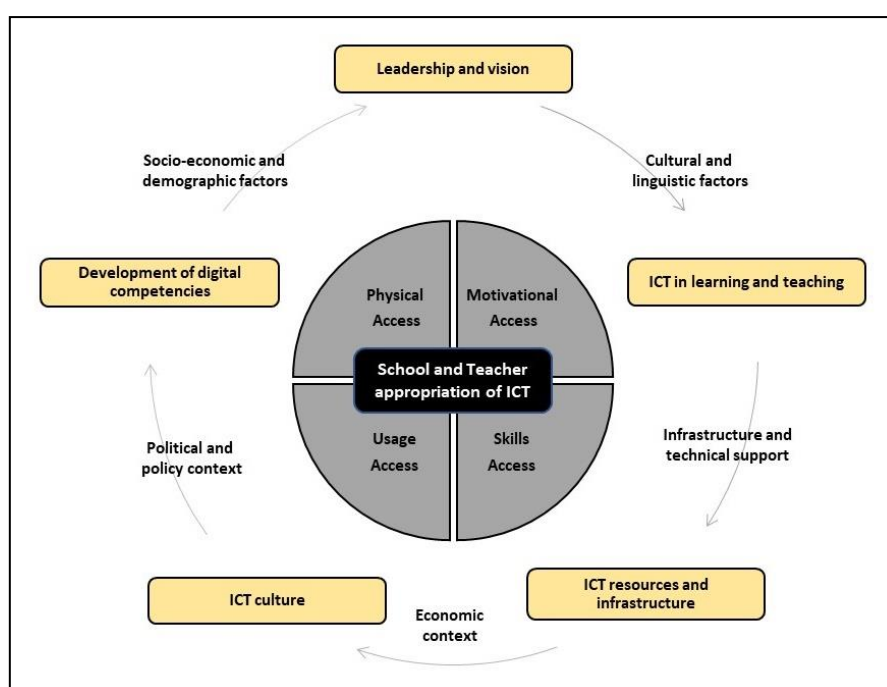


Figure 6: The Context-Aware ICT Appropriation model (CAIA) (Author's construct)

Applying this model will provide a more comprehensive understanding of a school's strengths and weaknesses in terms of technology integration. This knowledge should guide the school's ICT integration strategy and plans, ensuring the sustainability of ICT implementation projects within educational institutions. Schools must develop a comprehensive ICT strategy, setting out the aims, principles, and strategies for the adoption and use of ICT, with the input of all stakeholders. The ICT strategy must guide teachers and learners in navigating through the ICT environment and enable the integration of ICT in teaching and learning. Secondly, schools must continuously monitor and improve their e-readiness, in other words, the school's capacity and capability to provide appropriate structures to deliver effective educational experiences using ICT.

7. Conclusion

The study was motivated by the absence of a thorough understanding of teachers' access to and use of ICT in varying scenarios. The findings of this study suggest that the relationship between teachers' access to ICT and their actual use of it is not straightforward. While physical access is a fundamental requirement, it does not automatically translate into effective technology use. This research asserts the need for a more intricate and nuanced understanding of the multifaceted concept of ICT access, one that more accurately reflects how teachers actively interact with ICT in an increasingly technology-driven society.

The researcher believes that this study has enriched the theoretical and practical aspects of the field, laying a foundation for future research. Evaluating the CAIA model's practical effectiveness and its ability to overcome the limitations of isolated technology interventions is essential. The researcher advocates for future studies to assess the practicality and effectiveness of the proposed CAIA model. This encourages further examination of the model's real-world applicability and efficiency.

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