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ICT Use and Pedagogic Transformation in Secondary Schools in Cameroon

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ABSTRACT

This study examines the relationship between ICT use and pedagogic transformation in secondary schools in Cameroon, with a focus on how digital technologies are reshaping teaching and learning practices. The study adopts a mixed-methods approach, combining quantitative and qualitative research designs to provide a comprehensive understanding of the phenomenon. Quantitatively, data were collected through structured questionnaires administered to teachers and students in selected secondary schools to assess the extent of ICT usage, availability of digital resources, and their influence on classroom practices. Qualitatively, interviews and focus group discussions were conducted with teachers, school administrators, and students to explore their experiences, perceptions, and challenges regarding ICT integration in pedagogy. The findings reveal that ICT tools such as computers, projectors, internet platforms, and mobile applications have contributed to significant pedagogic transformation by promoting learner-centred teaching, interactive learning, and access to diverse educational resources. Statistical analysis indicates a positive relationship between ICT use and improved teaching effectiveness, student engagement, and academic participation. Qualitative findings further show that ICT facilitates collaborative learning, creativity, and flexible instructional strategies. However, challenges such as inadequate infrastructure, limited teacher training, unstable electricity supply, and unequal access to digital tools continue to constrain effective implementation. The study concludes that while ICT has strong potential to transform pedagogy in Cameroon's secondary schools, sustainable policy support, infrastructure development, and teacher capacity building are essential for maximising its benefits.

Keywords: ICT; pedagogic transformation; secondary education; teaching practices; Cameroon

1. INTRODUCTION

The accelerated advancement of digital technologies has fundamentally altered the landscape of education worldwide, prompting a paradigm shift from traditional instructional approaches toward technology-enabled pedagogical transformation. In contemporary educational discourse, emphasis has moved beyond the mere use of ICTs to ICT transformation, which entails the systematic reconfiguration of teaching practices. Learning processes and institutional cultures through the strategic integration of digital technologies. ICT transformation is increasingly regarded as a critical driver of pedagogical innovation, learner engagement and educational quality, particularly in developing contexts where access and equity remain persistent challenges. Studies across Sub-Saharan Africa increasingly affirm that when ICTs are meaningfully used in classroom practices, they can improve students' cognitive engagement, promote collaborative learning and enable multimodal forms of knowledge construction (Tchombe, Nkwenti & Enonchong, 2020). Across sub-Saharan Africa, including Cameroon, ICT transformation has been positioned as a catalyst for improving instructional effectiveness and fostering learner-centred pedagogies. Educational reforms and policy initiatives have sought to promote transformative teaching practices by embedding digital technologies into curriculum design, instructional delivery, assessment and professional development. Empirical evidence suggests that when ICT transformation is effectively implemented, it enables teachers to adopt interactive, collaborative and multimodal pedagogical approaches that extend learning beyond the physical classroom and accommodate diverse learner needs.

2. THEORETICAL BACKGROUND

Various theories underpin the development and integration of information and communication technologies (ICTs) in educational systems. ICT draws on a diverse range of learning theories, including B. F. Skinner's behavioural theory of learning, Jerome Bruner's theory of instruction, Herbert A. Simon's information-processing theory, Lev Vygotsky's social development theory, and the cultural approach to learning, among others. These theories are relevant to the present study because they collectively emphasise learner engagement and active participation in the learning process.

In particular, many of these theorists advocate for student-centred learning, where learners take greater responsibility for constructing knowledge. The use of multimedia technologies, which combine text, graphics, video, animation, and audio in teaching and learning, has been shown to support productive, engaging, motivating, interactive, and high-quality classroom instruction while addressing the needs of diverse learners (Silva, 2015; Zhou & Brown, 2015). Skinner argued that environmental influences could be harnessed for either positive or negative outcomes (Passer & Smith, 2001; Zhou & Brown, 2015). According to Leeder (2022), Skinner was one of the most influential psychologists in shaping the behaviourist movement of the twentieth century. Between 1953 and 1956, he contributed to the development of the "teaching machine," a device designed to apply his programmed instruction methods. Behaviourism significantly influenced the transmission model and domain-centred instructional design, particularly in early educational technology applications.

The instructional theory developed by Jerome Bruner is also central to the application of ICT in education. Bruner emphasised discovery learning and encouraged teachers to provide students with opportunities to explore and learn independently (Bruner, 1956, as cited in Santrock, 2004). Another important framework in this study is the information-processing theory developed by Herbert A. Simon. This theory focuses on cognitive processes such as memory, thinking, and problem-solving. Santrock (2004) describes it as an attempt to explain how the human mind processes information. Similar to Jean Piaget's cognitive developmental theory, Bruner's theory and the information-processing perspective contributed to the development of learner-centred instructional design. According to Santrock (2004), Lev Vygotsky, like Piaget, believed that children actively construct knowledge. ICT supports this process by enabling students to create, access, and share knowledge independently and collaboratively. Vygotsky's theory has significantly influenced the cultural approach to instruction, which emphasises the role of social interaction and cultural context in learning. This perspective has encouraged deeper analysis of how contemporary ICT tools are integrated into educational systems. Such ideas contributed to the development of activity-centred instructional design and activity theory. The systemic model proposed by Michael Cole and Yrjö Engeström identifies three critical interactions within each activity system (Bottino et al., 1999).

Educators have extensively applied Howard Gardner's theory of multiple intelligences to adapt teaching practices to students with different cognitive strengths (Gardner, 1983). This theory has influenced both assessment practices and instructional strategies by encouraging more inclusive and differentiated approaches to teaching (Passer & Smith, 2001). Pierre Lévy's (1997) concept of collective intelligence provides valuable insights into ICT-supported learning. Collective intelligence refers to the shared or group intelligence that emerges through collaboration and digital connectivity. In educational settings, this concept is particularly relevant because ICT enables learners and educators to interact, exchange ideas, and co-construct knowledge in virtual environments (Zembylas & Vrasidas, 2005). These theories illustrate the evolution of educational thought from behaviourism, which emphasises the role of technology and individual responses, to socio-constructivism, which focuses on pedagogical design, the social nature of learning, and the development of collaborative learning communities.

3. CONCEPTUAL FRAMEWORK

A conceptual framework provides the structure that guides a research study by identifying and explaining the key concepts, variables, and relationships relevant to the topic under investigation. It serves as a map that helps the researcher understand how different elements of the study are connected and how they influence one another. In educational research, a conceptual framework is particularly important because it links theoretical ideas to practical realities, thereby providing a basis for analysing the phenomenon under study. For this research, the conceptual framework illustrates the relationship between the selected independent variables and the dependent variable, showing how the identified factors interact to influence the outcome of the study.

3.1. From Policy to Practice: Evaluating ICT Transformation in Cameroonian

The COVID-19 pandemic further accelerated the urgency of ICT transformation in education systems. Prolonged school closures compelled teachers to reconfigure their pedagogical practices through technology-mediated alternatives such as video-based instruction, online platforms, and mobile learning tools. This period marked a turning point, highlighting the potential of digital platforms to sustain pedagogical practices during crises (Passey, Rogers, Machell, McHugh, & Allaway, 2003). This unprecedented disruption exposed both the potential and the limitations of ICT transformation within the Cameroon education system. While some teachers demonstrated adaptability by embracing video-mediated pedagogical practices, many others struggled due to inadequate infrastructure, limited digital competencies, and insufficient institutional support.

Despite sustained policy efforts by the Ministry of Secondary Education to promote digital integration, ICT transformation in Cameroonian secondary schools remains uneven and largely constrained. Although teachers generally acknowledge the usefulness of ICTs for instructional enhancement, several studies report persistent gaps between policy expectations and actual classroom practices (Asare & Barfi, 2021). In many cases, technology adoption has not translated into meaningful pedagogical transformation, as instructional practices continue to be dominated by teacher-centred and examination-driven approaches.

Studies indicate that the absence of sustained professional development, limited access to digital resources, and weak implementation frameworks have hindered teachers' ability to leverage ICT transformation to enhance instructional quality and learner engagement. New technologies are transforming education globally at an unprecedented rate. As ICTs (Information and Communication Technologies) become deeply embedded in knowledge distribution and access, they are redefining what learners need to know, how they learn, and where and when learning takes place. However, the presence of change in knowledge does not guarantee success, but its absence often ensures failure (Elmore, 2004, as cited in Spillane et al., 2018). In this context, the critical challenge for educational systems, especially in developing countries such as Cameroon, is how effectively teachers adapt to innovations and integrate them to make pedagogical practices more meaningful.

Over the past two decades, the Government of Cameroon has demonstrated strong policy commitment to ICT transformation in education through frameworks such as the National ICT Policy and the E-Education Strategy. These policy documents highlight goals such as equipping schools with digital infrastructure, developing teachers' competencies in ICT, and using technology to create relevant, flexible, and student-centred learning environments. The National Educational Technology Plan (2017) similarly emphasises the role of teachers in equipping learners with 21st-century skills and using ICTs to foster critical and creative thinking. However, implementation on the ground remains fragmented and uneven. Despite increasing interaction with digital connectivity tools such as the internet, teachers in Cameroonian secondary schools rarely use technology effectively in the teaching-learning process. Many still rely on traditional, teacher-centred approaches, providing both teachers and learners with limited opportunities to select and utilise technological tools that are relevant to their instructional needs. Furthermore, access to technological resources remains inadequate, giving teachers and learners only limited opportunities to engage, collaborate, and experience meaningful interactions with ICT tools in the classroom.

3.2. The Emergence of ICT in Cameroon's Educational Sector

The private education sector has preceded the public sector in the pedagogical transformation of ICT. Thus, long before the development of ICT curriculum in the Ministry of Basic Education and Secondary Education, many private primary, secondary and technical colleges in the major cities had acquired computers and started teaching courses on and with ICT. The government's involvement in this sector began with the development of the general policy and strategy document for the use of ICTs in all sectors by the National Agency of ICT (ANTIC) and the creation of multimedia resource centres in some high schools (Ngwa, 2023). It is noteworthy that the Cameroonian educational system has undergone continual evolution in terms of its policies, strategies, techniques and practices, which have been influenced by the country's political development and needs. However, it is essential to review its history in order to analyse the concepts and advancements that have moulded educational practices in order to construct the first professional training in Cameroon's schools. The history of education in Cameroon is extensive.

3.3. The ICT transformation in Secondary Schools

The modern development of global education indicates that the concept of media literacy has become a necessary component in the formation of highly intelligent and highly qualified professionals. The influence of media culture on personality development and personal qualities, particularly within the educational sphere, has been emphasised by Béché (2013), who defines media culture as the combination of information and communication tools together with material and intellectual values. In this sense, media culture contributes significantly to shaping socio-political consciousness in developing societies. Teachers' use of ICT in Cameroon has remained less than optimal despite the potential educational benefits associated with integrating ICT into teaching and learning. Teachers may not fully benefit from ICT for various reasons, including inadequate training, resistance to change, and limited institutional support. This situation may partly be explained by the historical lack of emphasis on ICT in the national education agenda. For instance, during the National Forum on Education held in Yaoundé from 22 to 27 May 1995, little attention was given to the role of ICT in schools. However, the Law of Orientation of Basic and Secondary Education did make reference to the integration of technology in education.

Media literacy can be understood as the process of preparing an individual to become media literate through the acquisition of information competence. This competence is shaped by an understanding of the sociocultural, socio-political, and intercultural contexts in which media culture operates in the modern world. It also involves the ability to interpret both explicit and implicit information embedded in media messages (Khotimah & Reza, 2022). In recent years, the terms information technology (IT) and information and communication technology (ICT) have been widely used to describe modern computer and telecommunications functions. Broadly, ICT in education serves three major purposes: the organisation and management of the educational process; teaching and learning under the guidance of a teacher, whether in face-to-face or remote settings; and the independent study of specific disciplines.

In practice, the use of ICT in language teaching began to expand in the mid-1980s with the introduction of various applications such as word processors, spell-checking software, electronic dictionaries, spreadsheets,

desktop publishing tools, encyclopedias, games, and other programs (Erfan, Sulisyaningsih, & Syakur, 2023). The second stage of ICT integration in language teaching emerged in the 1990s and was associated with significant improvements in computer capabilities and the wider spread of digital technologies in the learning process. The beginning of the 21st century marked a new phase characterised by the use of virtual reality in education (Asare & Barfi, 2021). In virtual classrooms and laboratories, students have the opportunity to work in simulated speech and communication environments, which broadens opportunities for improving language and cognitive skills while creating optimal conditions for the development of communicative and socio-cultural competence (Erfan et al., 2023).

The Law No. 98/004 of April 14, 1998, on Education, which was largely based on the recommendations of the National Education Forum, acknowledged in general terms the potential contribution of ICT to education. Section 25 (Part III) states that education provided in schools should take into account scientific and technological advancement and should be adapted in terms of content and methods to national and international economic, scientific, technological, social, and cultural trends. ICT was officially introduced into the Cameroon secondary education system in February 2001 when the President, in his address to the youth, encouraged them to embrace the knowledge economy (Wirba, 2025). Consequently, computers were introduced into many general secondary schools and technical/vocational secondary schools, and numerous institutions benefited from presidential grants for multimedia centres connected to the internet.

3.4. ICT Integration in Secondary Education in Cameroon: Challenges, Current Realities, and Strategic Perspectives

This initiative was introduced to address the numerous challenges affecting secondary education in Cameroon, including acute shortages of basic pedagogical materials and human resources, overcrowded classrooms, issues of relevance and quality, and limited access to education. The integration of information and communication technologies (ICT) has the potential to address some of these challenges. For instance, ICT can improve access to education, promote equity, and enhance the quality of teachers' professional development (Nsolly & Charlotte, 2016). Despite these initiatives, there is still no clearly defined and recognisable national strategic plan for integrating modern technology into school curricula and pedagogical practices. In most secondary schools in Cameroon, the use of ICT depends largely on school leadership as well as the dynamism and enthusiasm of individual teachers.

Many secondary schools have adopted ICT policies and are in various stages of implementation. Although significant educational research has been conducted in other countries on the use of ICT in schools, most findings remain context-specific because of differences in population, sampling, and research design. Consequently, such findings cannot be directly generalised to the Cameroonian context, where teachers' experiences with modern technology vary due to the relatively recent introduction of ICT in schools and the influence of distinct cultural and institutional backgrounds (Moluayonge & Innwoo, 2017). However, only a limited number of studies have examined ICT use among teachers in Cameroon's secondary schools. It is therefore important to investigate teachers' perceptions regarding ICT access, ICT training, ICT competencies, leadership support, and actual ICT use. Findings from such studies could have important implications for school administrators, educational departments, students, and employers, as they may contribute to improving educational delivery, enhancing students' learning experiences, and strengthening the application of knowledge and skills in the world of work. For these reasons, it is necessary to examine teachers' perceptions and ICT usage in education.

The importance of technology in education has attracted the attention of educators since the introduction of motion pictures in the early twentieth century. However, computers became accessible to teachers and students only in the mid-1970s when they were introduced into educational settings (Brush, cited in Hew & Thomas, 2007). Since then, research has consistently shown that a technology-integrated curriculum offers numerous advantages, including increased student motivation and improved learning outcomes (Wanji et al., 2015). This belief in the effectiveness of technology in education has led many governments to establish programs aimed at integrating ICT into their educational systems. For the same reasons, Cameroon has made efforts to incorporate technology into its curriculum since 2001. Nevertheless, these efforts have not yet achieved the expected success due to several barriers that also affect developed countries such as the United States, which is often regarded as a leader in educational technology integration (Becker, 2000).

One major barrier, common in many Sub-Saharan African countries such as Comoros, the Republic of the Congo, Guinea, Lesotho, Madagascar, and Cameroon, is the absence of a clear vision and strategic plan for ICT use in education (Clark & Mayer, 2016). Other barriers include inadequate technological resources, insufficient knowledge and skills, and the attitudes and beliefs of teachers and parents toward technology. Given that continuous data collection, monitoring, and research are essential for improving ICT use in education (Nsolly & Charlotte, 2016), the main purpose of this paper is threefold. First, it reviews the major initiatives that have been undertaken in Cameroon to integrate ICT into secondary schools. Second, it analyses the current situation and the barriers identified through this review. Finally, it proposes practical strategies that could help improve the effective integration of ICT in secondary education.

3.5. Educational Governance and ICT Policy

The strength of any education system depends largely on its operational governance. In this regard, both the structure of governance and the extent to which educational goals are achieved are critical. Structurally, research has shown that decentralised or community-based models of educational governance have proven successful. This mode of governance has long existed in many developed nations, where the management of educational issues is largely entrusted to local communities. However, this is not the case in most countries of Central Africa, including Cameroon. In fact, the governance of Cameroon's education system has traditionally been underpinned by a centralised model. According to Cukur (2023), the centralised model has fallen short in identifying and addressing real educational challenges. Today, the education system faces serious difficulties, as the confidence placed in its mission to equip learners with the appropriate skills for the 21st-century job market has significantly declined. It therefore follows that key variables of the education system, such as policy design, deserve careful examination.

According to UNESCO (2015, 2018), policy is a deliberate set of principles designed to guide decisions and achieve rational outcomes. It is a statement of intent implemented through procedures, guidelines, or protocols. This suggests that decision-making processes for crucial organisational matters, including the identification of relevant programs, action plans, and spending priorities to meet targeted goals in a particular domain, are central to policy. Policy thus serves as a framework that drives every sector of a nation's development. However, when policy focuses on a specific societal sector, it becomes more impactful, evidence-based, and easier to analyse and evaluate for possible improvement. In other words, policy must have a clear central focus. This discussion permits an examination of the focus of existing digital education policy in secondary education in Cameroon. For the most part, ICT-in-education policy has often been embedded within broader national development plans. This has made it rigid and weak, often lacking clear guidelines for integration into the education system. In this respect, Yusuf (2005), using Nigeria as an example, explains that although the Nigerian ICT policy document recognises the importance of digital technologies in education, it does not make provisions for specific vertical or sectoral applications in education. Instead, ICT issues in education were placed under the human resource development sector. The author further noted that Sections 1–4 of the policy document relate to education through objectives such as developing a pool of IT engineers, scientists, technicians, and software developers; increasing the availability of trained personnel; providing attractive career opportunities; and developing requisite ICT skills.

According to Yusuf (2005), while the policy document outlined promising strategies, it lacked specific applications to education. This has often compelled key funding partners such as the World Bank and the African Development Fund to recommend sectoral implementation plans before disbursement of funds (ADF, 1999). In addition, the author pointed out that the focus of the policy was mainly on human resource development, which is highly job-oriented and tends to prepare learners to seek employment rather than empowering them for job creation. Other researchers have argued that the reality in classrooms is even more concerning, as the focus is often limited to learning about ICT, which amounts only to "topicality."

In this context, Donnelly, McGarr, and O'Reilly (2011) posit that ICT requires serious implementation at the primary, secondary, and higher levels of education in order to enhance usability skills as early as possible. They concluded that the current dimensions of policy formulation significantly limit learners' potential to become active contributors to a knowledge-based economy. According to Culp Endeley (2018), poorly focused ICT policy in education, as described above, limits its potential as a tool for addressing challenges in teaching and learning, as well as its capacity to act as a transformative agent. The above discussion demonstrates that learners should not merely learn about computers in a theoretical sense. Rather, ICT should be integrated into the development and management of teaching and learning processes, while also fostering skills relevant to the current digital economy and the demands of the 21st-century workplace.

3.6. Pedagogical Practices in the 21st Century

It is the ability to apply learning in novel situations that makes for a successful student and, ultimately, a successful member of the 21st-century workforce. Research suggests that students learn more effectively when they are engaged in meaningful, relevant, and intellectually stimulating tasks, and that the integration of technology increases the frequency of this type of learning (Lambert & Cuper, 2008). Teaching that incorporates information and communication technology (ICT) ensures that students are actively engaged and allows them to practice learning in novel situations through relating, experiencing, applying, cooperating, and transferring knowledge (Darling-Hammond et al., 2020; Organisation for Economic Co-operation and Development, 2018). The beginning of the new millennium was marked by groundbreaking digital innovation. We now live in a complex, globally connected, and increasingly diversified media-saturated society. Martinez (2022) asserts that this revolutionary transition has had a greater impact on society than the historical shift from an oral to a written civilisation. As a result of these technological advancements, students are now expected to actively participate in the creation and use of information, while also being able to communicate effectively and function both locally and globally. Learning technologies for the digital era represent only one aspect of the profound changes brought about by technological innovation in everyday life.

Today's learners must continually interact with a wide range of digital platforms, including computer applications and social networking tools such as Web 2.0 technologies. These innovations are reshaping not only learners' behaviours and needs, but also the theories and principles that underpin learning processes, instructional design, and application development. In this regard, Uştuk (2022) emphasises that in the Connectivism model, the learning community is portrayed as a hub that constantly exists as part of a broader interconnected system. A study by Martinez (2022) further indicates that the traditional three R's of education, reading, writing, and arithmetic, have been replaced by rigour, relevance, and real-world skills for the 21st-century learner. It is therefore imperative for teachers to adapt their instructional approaches to align with the evolving needs of students. According to Martinez (2022), it is no longer sufficient to teach in the same way previous generations were taught, because the competencies required for success in modern society have significantly changed.

To remain competitive in the workforce, students must acquire 21st-century skills such as global awareness, scientific literacy, collaboration, and leadership, with technological literacy serving as the foundation for all of these competencies. Martinez also notes that cultural awareness and social responsibility are essential, particularly because much of students' communication and work now occurs on a global scale (Vallera & Harvey, 2022). In a study on teachers' use of technology resources, Lei found that the use of social communication technologies had a significant positive relationship with student development and a moderate positive relationship with student achievement. The study also revealed that the entertainment-exploration use of technology contributed positively to students' learning habits (Lei, 2019). Research has further suggested that educational practices integrating technology have a positive effect on student achievement. For instance, Drijvers et al. (2018) examined the impact of technology-enhanced instruction in mathematics and found that students exposed to visually rich digital tools and interactive design-based learning significantly outperformed their peers on standardised assessments. Their findings revealed higher pass rates among students who actively engaged with instructional technologies compared to those who did not participate in technology-supported learning activities.

3.7. School, Teachers, and Students in the 21st Century

Schools in the 21st century are expected to implement problem-based instructional approaches that consistently engage students in addressing meaningful questions and challenges relevant to humanity. Modern schools have evolved beyond physical buildings into dynamic learning hubs with permeable and transparent boundaries, providing learners and stakeholders with access to the vast body of knowledge available worldwide and enabling communication across global networks. In this context, the transition from a traditional teacher-centred system, characterised by textbooks, chalk, and blackboards, to a student-centred educational system has become increasingly significant. The teacher's traditional role as the sole dispenser of knowledge is gradually being replaced by that of a facilitator of learning, guiding students in transforming knowledge into meaningful learning experiences and data into useful information (Subashini et al., 2022). A 21st-century student, according to Hover and Wise, is a learner who studies and collaborates with classmates and peers from around the world within a global classroom. This contrasts sharply with the traditional view of students as individuals who simply attended school, completed prescribed courses, obtained passing grades, and eventually graduated (Subashini et al., 2022). Today's learners are expected to be active participants in knowledge construction, critical thinkers, and global citizens capable of navigating complex technological and social environments.

The phenomenon of globalisation has become an unavoidable process that makes different parts of the world increasingly interconnected, transparent, and interdependent. It is driven largely by the rapid advancement of Information and Communication Technology, which influences nearly every aspect of national life, including ideology, politics, economics, socio-cultural systems, and national security. Globalisation also introduces universal values, such as individualism, which may challenge traditional communal values such as cooperation, tolerance, and politeness, particularly among young people (Gillan, 2020). Recent studies indicate that globalisation has significantly shaped youth behaviour. According to Moskos and Burk, the atmosphere of globalisation can reduce young people's interest in activities associated with patriotism and nationalism. Similarly, Wahdani and Abi Aufa observed that many young people are increasingly attracted to lifestyles influenced by Western culture, including dietary habits and clothing styles. Social challenges such as student violence, drug abuse, and risky sexual behaviour suggest a decline in certain societal values among students, despite the presence of strong cultural norms in many countries (Goh & Kananatu, 2020). In this changing landscape, technology plays a prominent role in supporting educational reform. Digital tools have transformed teaching and learning by expanding access to information, fostering collaboration, and promoting innovative pedagogical approaches. Consequently, schools, teachers, and students must adapt to the demands of the 21st century by embracing technological advancement while maintaining the ethical and cultural values necessary for holistic development.

3.8. Technological Resources Used in the Classroom

Technological tools in education encompass a broad spectrum of resources, including hardware (projectors, laptops, smart TVs), software and applications (PowerPoint, video editors, simulations), multimedia content (YouTube videos, animations),

connectivity tools (Wi-Fi, mobile data, internet), communication platforms (WhatsApp, Zoom, Google Meet), data storage devices (flash drives, cloud storage), and support infrastructure (electricity, ICT maintenance services). These tools serve various pedagogical functions, from lesson planning and presentation to facilitating learner feedback and resource sharing.

3.8.1. Hardware

Hardware constitutes the physical technological infrastructure that facilitates the use of ICT in education. It includes devices such as desktop computers, laptops, projectors, televisions, interactive whiteboards, smartphones, tablets, cameras, and DVD players, all of which serve as enablers for delivering and enhancing classroom instruction. According to UNESCO (2018), these devices form the basis for digital teaching and learning environments. In video-mediated lessons, hardware plays a foundational role in presenting, recording, transmitting, and interacting with video content, thereby transforming traditional teaching into a more dynamic, engaging, and multimodal process. According to Robin H. Kay (2018), effective video integration in classrooms depends heavily on the availability and functionality of appropriate hardware, such as projectors, speakers, and computer systems capable of displaying high-quality educational videos. Similarly, Mark Bond et al. (2020) and Johannes König et al. (2022) emphasise that without physical tools to access and deliver content, digital pedagogy cannot move beyond theory into practical classroom application.

In Cameroon, access to hardware remains a critical determinant of pedagogical effectiveness. Teachers often rely on personal devices such as smartphones or external storage drives to access or share instructional videos, particularly where institutional infrastructure is lacking. The presence of projectors and TV screens enables teachers to demonstrate real-world processes through recorded experiments, animations, or visual examples, especially in science, geography, and vocational education subjects. Moreover, hardware enhances teacher autonomy and professional creativity, allowing educators to record their own lessons, edit content, or use mobile phones to demonstrate local or practical examples. However, Peggy A. Ertmer (2019) cautions that mere possession of hardware does not guarantee effective use; teachers must also possess the pedagogical knowledge and motivation to integrate these tools meaningfully into lesson design.

3.8.2. Software and Applications

Software and applications constitute a vital component of educational technology, functioning as the digital engines that enable the planning, delivery, and evaluation of pedagogical activities in modern classrooms. Unlike hardware, which provides the physical medium, software delivers the instructional logic, interactivity, and pedagogical structure required for effective technology-enhanced learning. In the context of video-mediated instruction, software tools are indispensable for streaming, editing, presenting, and managing video content, thereby supporting both synchronous and asynchronous learning models. Recent research shows that applications such as Microsoft PowerPoint, YouTube, Edpuzzle, Google Classroom, Filmora, and Kahoot! have significantly transformed traditional pedagogical practices by offering interactive, multimodal, and learner-centred platforms.

These tools allow teachers to prepare lessons enriched with visual and auditory stimuli, align video content with learning objectives, and assess student engagement in real time. According to recent studies, software integration enhances lesson delivery and fosters higher-order thinking skills such as analysis, evaluation, and problem-solving. Applications like Google Forms allow teachers to conduct quick assessments after video lessons, while Edpuzzle enables the embedding of questions directly into instructional videos, ensuring that learners remain engaged and accountable. In Cameroon, teachers often rely on freely available or low-data-consuming applications such as WhatsApp, Telegram, and VLC media player to share educational content and engage learners outside traditional classrooms. However, scholars such as Matthew J. Koehler et al. (2017) caution that although software availability is expanding, many teachers still lack the Technological Pedagogical Content Knowledge (TPACK) necessary for effective integration.

3.8.3. Multimedia Content and Resources

Multimedia content and resources refer to digitally formatted educational materials that combine text, images, audio, video, animation, and interactive elements to enhance learning. These resources are fundamental in supporting video-mediated instruction and transforming pedagogical practices into more engaging, multimodal, and inclusive processes. According to Richard E. Mayer's Cognitive Theory of Multimedia Learning (2001, 2009), students learn more effectively when information is presented through both visual and auditory channels, thereby increasing retention, comprehension, and learner engagement. Tools such as educational videos, interactive simulations, infographics, animations, and narrated presentations are widely used to support active learning and differentiated instruction. In video-mediated lessons, multimedia content such as YouTube tutorials, interactive videos, virtual science labs, and subject-specific animations serves as both a teaching aid and a learning facilitator. Platforms such as Khan Academy, TED-Ed, and PhET Simulations provide freely accessible multimedia resources that align with STEM and humanities curricula. Empirical studies in Cameroon and other sub-Saharan African contexts show that teachers who incorporate multimedia resources into lessons report increased student motivation, improved classroom participation, and better academic performance. The use of locally contextualised multimedia, such as vernacular video clips, regional documentaries, and culturally relevant animations,

has also been shown to improve comprehension in multilingual classrooms.

3.8.4. Connectivity Tools

Connectivity tools refer to the technological infrastructure and digital platforms that enable access, interaction, communication, and information retrieval through the internet or intranet. These tools include Wi-Fi, mobile data, modems, routers, mobile hotspots, and cloud-based services. Using video-mediated lessons as an example, connectivity is not simply a technical requirement; it is the gateway through which multimedia resources become pedagogically usable. Without reliable internet access, even the most effective instructional videos or online tools become inaccessible to teachers and learners, particularly in under-resourced areas. According to Terry Anderson and Jon Dron (2011), effective teaching in digital environments requires tools that support interaction and content access. Thus, connectivity tools are essential for accessing platforms such as YouTube, Zoom, Google Classroom, and WhatsApp. In Cameroon, connectivity tools are transformative, particularly where teachers rely on mobile data bundles or community internet cafés to download, stream, or share educational videos. These tools support blended and flipped learning models, allowing students to engage with video content at home and participate in discussions in class.

3.8.5. Audio-Visual Tools

Audio-visual tools are among the most impactful technologies used to enhance pedagogical practice, particularly through video-mediated instruction. These include projectors, smart TVs, speakers, radios, DVDs, cameras, and audio recorders, which present content in both auditory and visual formats. These tools are particularly beneficial for subjects requiring practical demonstrations, such as home economics, biology, geography, and ICT. For example, a geography teacher may use videos to demonstrate landform formation, while a biology teacher may show animations of human anatomy or health practices. Studies in urban areas such as Yaoundé and Douala indicate that many teachers use YouTube videos, recorded television programs, or PowerPoint presentations with voice-over narration to support instruction. In more rural settings, portable DVD players and Bluetooth speakers are commonly used where internet access is limited.

3.8.6. Data Storage Tools

Data storage tools are devices or platforms that enable teachers to save, retrieve, and organise digital teaching materials. These include USB flash drives, external hard drives, SD cards, and cloud storage platforms such as Google Drive and Microsoft OneDrive. In Cameroon, where many schools lack institutional digital repositories, teachers often use personal storage devices such as flash drives and memory cards to transport instructional videos, PowerPoint slides, and lesson notes. These tools are especially valuable in areas where school computers or internet access are unreliable. Research indicates that teachers who regularly use storage devices to archive instructional videos are more likely to reuse, adapt, and improve their teaching materials over time. However, these tools also present challenges, including vulnerability to virus infections, accidental deletion, and physical damage. As a result, scholars recommend training teachers in digital security practices and cloud storage management.

3.8.7. Sharing Tools

Sharing tools enable teachers to exchange educational materials and feedback, either synchronously or asynchronously. These tools include platforms such as WhatsApp, Telegram, email, Bluetooth, classroom intranets, and Learning Management Systems (LMS). In the Cameroonian secondary school context, WhatsApp has emerged as the most widely used sharing tool among teachers. According to Ateh & Mbah (2020), over 70% of teachers surveyed reported using WhatsApp to send videos, PowerPoint presentations, audio explanations, past examination questions, and assignments to both students and colleagues. Its popularity is attributed to its low data consumption, ease of access, and offline file-saving capabilities. Bluetooth and SD card transfers are also common in schools with limited or no internet connectivity, where teachers exchange educational content physically using mobile phones, particularly in rural and semi-urban areas (Ateh & Mbah, 2020). Email is mostly used in formal school settings, while LMS platforms such as Google Classroom are still in their infancy due to infrastructural limitations and inadequate teacher training (Ateh & Mbah, 2020). Sharing tools also promotes collaboration and professional development among educators. Teachers often form subject-based WhatsApp groups to discuss lesson ideas, share instructional resources, and reflect on teaching experiences, thereby fostering a community of practice (Fomunyam, 2020).

3.8.8. Communication Tools

Communication tools refer to digital platforms and technologies that facilitate two-way interaction between teachers and learners, as well as among educators and school administrators. These tools include instant messaging applications such as WhatsApp and Telegram, email, SMS, video conferencing applications like Zoom and Google Meet, as well as institutional communication systems. In Cameroon's secondary education landscape, communication tools have played a pivotal role in sustaining instructional continuity, especially during periods of sociopolitical instability and school closures. Ateh & Mbah (2020) report that many teachers in the Northwest Region and Southwest Region used WhatsApp and SMS to reach students when physical access to schools was disrupted. These platforms enabled educators to send video links, voice notes, PDF documents, and recorded explanations, thereby forming the basis of informal video-mediated instruction. Khotimah & Reza (2022) note that although the adoption of formal Learning Management Systems remains low, informal communication tools are increasingly being

used as pedagogical support systems. Teachers frequently create subject-specific WhatsApp groups where students can ask questions, watch lesson videos, and submit assignments. These tools promote asynchronous learning, which is particularly valuable in environments where internet connectivity is unstable or intermittent.

Ateh & Mbah (2020) observe that communication tools contribute significantly to the development of professional learning communities (PLCs) among teachers. Through online groups and digital forums, educators collaborate on lesson planning, share video resources, and exchange pedagogical solutions in the absence of centralised ICT training programs. However, Ewane and Ngefac (2019) caution that despite their usefulness, overreliance on informal communication platforms raises concerns about content credibility, digital overload, and monitoring challenges. They recommend that the Ministry of Secondary Education develop regulated e-communication channels specifically tailored for pedagogical purposes.

3.9. Power and Maintenance Infrastructure

The integration of technological tools in teaching is heavily dependent on the availability of supporting infrastructure, particularly electricity supply and maintenance services. Although often overlooked, these constitute critical enablers of consistent ICT use in schools (Lambert & Cuper, 2008). In a multi-regional assessment, Martinez (2022) found that unreliable electricity supply remains a major barrier to the use of projectors, computers, and smart devices in secondary schools, especially in rural areas. Teachers expressed frustration over frequent power outages, which interrupted video presentations and, in some cases, damaged ICT equipment. To address this challenge, some urban schools have invested in backup generators and solar energy systems; however, such solutions remain unaffordable for most public schools. In addition, the issue of technical maintenance and support remains inadequately addressed. Nsolly & Charlotte (2016) observed that many schools lack ICT technicians, and broken projectors, desktop computers, or network routers often remain unrepaired for extended periods. Teachers are sometimes expected to troubleshoot these devices themselves, which discourages regular ICT use.

Tchombe, Nkwenti & Enonchong (2020) argue that maintenance policies and ICT sustainability plans should be integrated into every school's development strategy. They propose the establishment of school-level ICT committees responsible for monitoring equipment functionality, planning upgrades, and liaising with regional ICT offices for technical support. Such systems would not only reduce downtime but also enhance teachers' confidence in using digital tools more frequently. In essence, the reliability of power supply and the availability of maintenance support constitute foundational conditions for the effective use of video-mediated lessons and other ICT-dependent pedagogical strategies.

4. METHODOLOGY

4.1. Research design

Research design refers to the overall plan or strategy used to guide a study. This study adopted a survey research design. According to Ogutu (2012), survey research is one of the most appropriate methods available to social scientists who seek to collect original data for the purpose of describing a population that is too large to observe directly. To determine and examine the relationship between the dependent and independent variables, a mixed-methods approach was adopted. This approach enabled the researcher to both quantify and qualify the relationships between variables. The relationships were expressed using statistical measures such as correlations, relative frequencies, means, and percentage differences (Creswell, 2003). In this survey, the independent variables were identified and studied in their natural settings, while observations and analyses were conducted to establish the relationships among them. Although there are different types of research designs, the survey design was considered most suitable for this study. Information was collected using questionnaires, structured interviews, observation, and document analysis. The survey design allowed the researcher to investigate possible relationships between variables. It was appropriate for the study because it facilitated data collection from a broad category of respondents and enabled comparisons among variables. The independent variable in this study was the use of ICT, while the dependent variable was pedagogical practices in secondary schools. A mixed-methods approach was therefore used to examine teachers' pedagogies, perceptions, opinions, beliefs, and practices in relation to ICT use in teaching and learning processes in Cameroon secondary schools. Data collection was essential for verifying the hypothesis and answering the research questions guiding the study with a population of 532 participants.

4.2. Research Question

How does teachers' access to and utilisation of ICT tools influence pedagogic transformation in some secondary schools in Cameroon?

4.3. Hypothesis of the Study

Teachers' access to and utilisation of ICT tools significantly influence pedagogic transformation in some secondary schools in Cameroon.

5. FINDINGS

This section presents the results of the qualitative analysis on the use of ICTs and teachers' pedagogic practices. Within this theme, the findings highlight the influence of ICT on the educational role and practices of teachers. Teachers need to recognise that they are not only content experts; their role increasingly requires new pedagogical approaches that provide reliable, experiential, and motivating learning experiences through the effective use of diverse technologies. Such approaches are necessary to meet the varied learning needs of the 21st-century learner. Teachers must therefore prepare to serve as facilitators who can support students in the

processes of learning, exploration, and discovery if they are to remain relevant in contemporary education. This theme illustrates how teachers use ICTs to shape authority, interaction, and control within the classroom. The interviewees narrated their experiences as secondary school teachers and expressed diverse viewpoints regarding ICT usage. The theme provides a foundation for interpretation by situating the teacher within the pedagogical context. The researcher was particularly interested in obtaining information from interviewees on several dimensions: their understanding of ICTs in education, the training and professional development they had acquired, the various technological tools they used in the classroom, and the challenges they encountered in the process of using these technologies.

Three categories of ICT users emerged from the observations and interviews conducted in the different schools: active users, passive users, and non-users. Active users referred to teachers who made use of available materials or relied on personal initiative to improvise and integrate ICT tools into teaching. Passive users included teachers who used these technologies mainly for research, lesson planning, recording scores, and administrative purposes. Non-users referred to teachers who saw no need to incorporate ICT tools into their pedagogic practice. Beginning with active users of ICT tools in the pedagogic process, many examples were observed of how these teachers integrated ICT tools into their classrooms. Generally, all the teachers interviewed demonstrated some understanding of the concept of ICT. One of the definitions provided was: "It is using modern technology and computer science to facilitate the teaching and learning process." (Interview transcript – Home Economics teacher).

Teacher 2 defined ICT in education as a teaching method that makes use of technology. In her words: "It is a technological method through which our teaching and learning process is facilitated through the use of the internet." (Interview Transcript – English Language teacher). The third teacher also demonstrated knowledge of ICT in education and noted that: "It is the use of modern technologies like projectors and laptops to enhance your lesson during the learning process." (Interview Transcript – Economics teacher). The fourth teacher's definition was not very different. He defined ICT in education as: "The use of gadgets like telephones and laptops to teach." (Interview Transcript – Mathematics teacher). Regarding teachers' training and professional development, the researcher sought to determine whether teachers' knowledge, skills, abilities, and competencies were prerequisites for the use of technology, or whether these were accumulated through experience over years of teaching. The participants revealed that through their experiences in school, they had developed skills that facilitated the integration of ICT into their teaching practices. In this theme, the study reports on how teachers acquired different ICT skills. The research participants narrated their personal abilities, their teaching experiences, and the diverse perspectives shaped by these experiences. They also believed that continuous training and professional development were crucial for improving not only pedagogical skills but also practical ICT skills.

This female Home Economics teacher, with eight years of teaching experience, shared a similar view. She stated: "At the university level, I studied an ICT course, and my knowledge from this course gave me some basic skills. I can type, use the internet, use Microsoft Excel, Word, edit documents, make PowerPoint presentations, and use equipment like laptops and projectors." (Interview Transcript – Home Economics teacher). The second teacher had never attended any formal course on ICT but had participated in several seminars that encouraged teachers to use ICT in pedagogic practice. She attested that: "After my training as a teacher of English Language at the Higher Teacher Training College (Ecole Normale Supérieure), I attended several seminars organised every year by the Regional Delegation of Secondary Education to encourage teachers and train them on how to use technologies in the subject, as well as update them on syllabus changes. These seminars are more or less aimed at training teachers on basic computer skills. So instead of the pedagogical technological knowledge that we expect, only technological knowledge is given, which does not really facilitate or help me integrate it into my subject." (Interview Transcript – English Language teacher).

Although the majority of teachers were undecided about their proficiency in the use of educational technologies, this participant stood out as one who was proficient with spreadsheet programs such as Microsoft Excel, which she used to manage class records, including students' grades in assignments and examinations. She explained: "I may be very passive as far as using ICT in the classroom is concerned, but I process students' exams on my own using office application packages such as Microsoft Word for setting, typing, editing, and proofreading. Excel has helped me a lot in processing students' results." (Interview Transcript – English Language teacher).

Considering the training and professional development opportunities received by teachers, classroom observation revealed a contrary reality, as almost all the teachers observed were more or less passive and non-users of ICT during actual teaching. This was confirmed by an Economics teacher with 17 years of experience, who stated: "Seminars are organised where we are encouraged to use ICT in lessons, but as far as actual training is concerned, the effort is personal." (Interview Transcript – Economics teacher). Some schools encourage their teachers by providing free training with the support of a computer technician in the school multimedia centre. This Mathematics teacher explained: "The school has a multimedia centre where teachers are encouraged to upgrade their learning with the help of school computer technicians." (Interview

Transcript – Mathematics teacher). Some teachers also appeared to take personal initiatives to develop their ICT proficiency. A Geography teacher explained how belief in his own capability and competence enabled him to overcome some of the barriers to the use of ICT in his classes. Although he admitted that he was not adequately prepared for the challenges surrounding ICT use, he narrated how the skills he developed through trial and error, as well as through staff development programmes, acted as a catalyst for his engagement with ICT in the classroom and provided the confidence necessary to continue using ICT despite the hurdles encountered. He stated: "Yes, mostly my learning process has been through trial and error. I like learning new things, especially now that technology usage is becoming the norm. The more I practice with different programs, the more comfortable I get with them. I am definitely a hands-on type of teacher. Of course, sometimes we have ICT workshops, but they are simple awareness sessions. The biggest tasks have been self-taught. It has been me … luckily, I am a quick learner, and when I decide to do something, nothing really stops me. So, trial and error has worked for me." (Interview Transcript – Geography teacher). Technological tools are ubiquitous, and teachers tend to use different tools depending on how they help them achieve intended learning outcomes. From observation, not all classrooms were ICT-inclusive; rather, the school had a central multimedia centre for ICT use. It was observed that most teachers began their lessons using traditional teaching tools such as the blackboard, chalk, and lecture methods, with little or no integration of ICT. Contrary to this general pattern, some teachers were observed using technological tools during their lessons.

A Form Five Geography male teacher modelled the use of his laptop during instruction. He used it to demonstrate the step-by-step process of map reduction. From observation, his learning objectives were well aligned with the technological resources used, and he displayed strong mastery in the use of these resources. He appeared to be one of the few teachers who was both confident and proficient in integrating technology into pedagogical practice. Using his laptop, the teacher presented a detailed demonstration, explaining to students where to focus depending on the demands of the examination question. He carefully reduced the map from its original size to a smaller size while explaining the implications of scale. He emphasised that students should pay close attention to the scale of the map, noting that map reduction increases the numerical scale, while map enlargement decreases it. For instance, a map with a scale of 1:50, when reduced, becomes 1:100, whereas the reverse applies when a map is enlarged. Students, on their part, were keen and attentive. They followed the various steps involved, and with the demonstration, some students even exclaimed, "It's so easy!" Feedback from students was very positive, as they requested certain sections of the demonstration to be repeated for a clearer view and better understanding. Apart from the laptop, another teacher used her mobile phone in the teaching and learning process, though in a more passive manner, mainly for research purposes. In her words: "I use my phone to do research. Googling the internet enables me to find insights on how best to present my lesson. I also often conduct practical lessons using simulations. For instance, in cake baking, I show students how baking is done using the correct measuring tins. As a result, students are able to blend the theory learned with the practical lesson carried out" (Interview Transcript – Home Economics Teacher). Similarly, a Biology teacher explained that although she uses a mobile phone, she also makes use of still and motion pictures to bring learners closer to real-life situations. She explained: "Aside from my mobile phone, I use anything possible to bring students to real-life situations for better understanding. For example, in my lessons, I show students different images, motion pictures, and still pictures of the human lungs, including the shape the lungs assume during inspiration and expiration. The mobile phone then comes in at the end, where I show them the whole process for a clearer and better understanding" (Interview Transcript – Biology Teacher).

Other teachers use social media as a form of learning management system. A Form Five Geography teacher explained: "I created a WhatsApp group for Form Five Geography students. It functions like an LMS where assignments are given from time to time, interpretation and answering of examination questions are discussed, and concepts not well understood are clarified. To deepen students' understanding, websites are shared where students can search and read further" (Interview Transcript – Geography Teacher).

Another teacher described his use of WhatsApp in his class: "Personally, the majority of my lessons are delivered face-to-face. I resort to WhatsApp as a means of communicating with students, especially because they are in examination classes. Although WhatsApp Messenger offers opportunities for text, audio, image, and video communication, I mostly use text, voice notes, and websites for further reading. Students in this group also use the WhatsApp platform to exchange information and discuss formulas after difficult assignments" (Interview Transcript – Mathematics Teacher).

A Physics teacher also projected his lessons to engage students and provide clearer explanations. After being interviewed, he stated: "I mostly use PowerPoint projections, especially with examination classes. I explain as I project so that every student can see. I also project short clips, about a minute long, where students can observe how electrons converge around the nucleus. This is a concept students often perceive as abstract, but when projected, followed by pauses and explanations, the concept is grasped" (Interview Transcript – Physics Teacher).

This teacher expressed satisfaction with the use of projectors in lessons, noting that they helped him

attain his objectives faster and keep students engaged. However, he also highlighted several challenges: "Many times, I have been frustrated because there is no electricity to power the projector. Power cuts have caused me to resort to traditional teaching methods, and I often have to look for extra time to project the lesson. This is especially necessary for topics that are difficult to understand. Despite PowerPoint projection, the blackboard remains indispensable because it enables step-by-step explanations that are not always possible with PowerPoint. For instance, calculating and demonstrating equations is difficult, though not impossible, to project, but it makes it hard to conveniently follow students' understanding" (Interview Transcript – Physics Teacher).

He was not the only teacher facing such challenges. Other teachers also reported difficulties in using ICTs in the pedagogic process. One Home Economics teacher explained: "Time allocation is a hindrance to me because the time allocated for using the laboratory is too short and cannot accommodate a full lesson, given that some time is needed to set up the lab. Also, the inaccessibility of internet services has, from time to time, forced me to use my phone to confirm concepts I may have forgotten" (Interview Transcript – Home Economics Teacher).

An English Language teacher also expressed concern: "Getting students to pay attention during the learning process is a challenge. Students are often distracted and instead want to use these gadgets for their own interests, thereby frustrating the objective of the lesson. Moreover, most assignments that require the use of the internet are usually completed by only a few students" (Interview Transcript – English Language Teacher). An Economics teacher similarly described his challenges: "My phone enables me to carry out research, but it is often very challenging when the optic fibre connection is poor. As a result, accessing information becomes frustrating" (Interview Transcript – Economics Teacher). A Mathematics teacher complained about the lack of technological tools to facilitate teaching: "Using a mobile phone as an LMS has greatly facilitated my pedagogic process, but not without challenges. Many of my students do not possess their own mobile phones. As a result, they miss out on some discussions and only have to catch up later" (Interview Transcript – Mathematics Teacher).

Summarily, from the above analysis, most of the teachers appeared active in using technology during the interview sessions. However, practical classroom observations revealed that many were more passive users or non-users of technological tools. This suggests that ICT use in the classroom remains very limited. The integration of ICT into lessons is still largely superficial rather than fully embedded in pedagogical practice.

TABLE 1: Correlation Matrix Between ICT Utilisation and Pedagogic Transformation.

Correlations

			Teachers' access to and utilisation of ICT tools	Pedagogic transformation
Spearman's rho	Teachers' access to and utilisation of ICT tools	Correlation Coefficient	1,000	,721**
		Sig. (2-tailed)	.	,000
		N	532	532
	Pedagogic transformation	Correlation Coefficient	,721**	1,000
		Sig. (2-tailed)	,000	.
		N	532	532

***. Correlation is significant at the 0.01 level (2-tailed).*

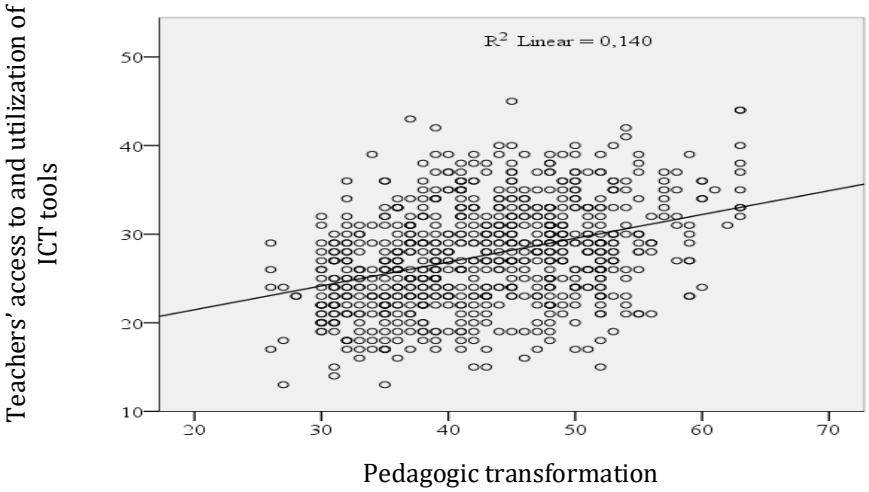

FIGURE 1: Scatter Plot and Linear Regression of Pedagogic Transformation of Teachers' ICT Access and Utilisation.

The findings reveal that the relationship between technological tools and pedagogic transformation in secondary schools in Cameroon is positive and statistically significant. This is based on the fact that the level of significance is 0.00, which is lower than 0.05, the accepted alpha level (standard margin of error). In addition, the correlation coefficient (r = 0.07) is positive, indicating the existence of a direct relationship between the variables under investigation. However, a coefficient of 0.07 indicates a weak positive relationship rather than a strong one, since values closer to 1 indicate stronger correlations. The results nonetheless suggest that there is sufficient statistical evidence to accept that an association exists between the variables. Therefore, it can be concluded that teachers' access to and utilisation of ICT tools significantly influence pedagogic transformation in secondary schools in Cameroon.

The scatter plot further reinforces the relationship between the variables. The data points show an upward trend, indicating a positive linear relationship between pedagogic transformation (x-axis) and Teachers' access to and utilisation of ICT tools (y-axis). Although the data points are moderately dispersed, the general clustering around the fitted line suggests some degree of consistency in the relationship across respondents. The regression line slopes upward, confirming that higher scores in pedagogic practices are associated with higher levels of technological tool use. This visual evidence corroborates the statistical findings, demonstrating that the relationship is not merely theoretical but observable across the dataset.

The coefficient of determination shown in the figure ($R^2 = 0.140$) indicates that approximately 14% of the variance in technological tool use is explained by pedagogic practices (or vice versa, depending on the model specification). While this percentage may appear modest, it is meaningful in educational and social science research, where teaching practices are often influenced by multiple interacting factors such as training, infrastructure, attitudes, institutional support, and policy context. This result, therefore, suggests that although pedagogic practices significantly influence the use of technological tools, other variables beyond pedagogy, such as availability of electricity, professional development, teacher beliefs, and school leadership, also contribute to ICT integration.

Teachers' access to and utilisation of ICT tools and pedagogic transformation are interconnected, implying that investments in ICT infrastructure alone may be insufficient unless they are accompanied by pedagogical reforms and teacher capacity building. Improving teachers' pedagogic competencies is likely to yield positive returns in ICT usage, while enhanced access to technological tools can also stimulate pedagogical innovation.

6. DISCUSSION

Data collected on this hypothesis were analysed using the Spearman rank correlation and multiple regression analysis. With regard to the research hypothesis, the findings revealed that technological tools significantly influence pedagogical practices. Statistically, the Spearman rank correlation coefficient was 0.721. This positive coefficient indicates a strong and positive relationship between technological tools and pedagogy. Furthermore, the significance level was 0.00, suggesting that the relationship is statistically significant and that the probability of error in concluding that technological tools positively affect pedagogical practices is negligible. This strong positive correlation implies that as teachers increase their use of technological tools such as educational software, learning management systems, multimedia content, and digital platforms, they are more likely to implement diverse and effective pedagogical practices. These may include collaborative projects, differentiated instruction, and formative assessment strategies. In Cameroon, while educators acknowledge the importance of digital literacy and responsible internet use, substantial barriers, particularly inadequate infrastructure, limited teacher training, and a lack of pedagogical integration, continue to restrict the effective use of ICT for communication, collaboration, and learner engagement. These findings align with several studies conducted in Cameroon and underscore the need for strategies that go beyond hardware provision to include targeted, pedagogically focused professional development and supportive policies that encourage the routine integration of ICT into pedagogical practice.

7. CONCLUSION

The integration of ICT in secondary schools in Cameroon has significantly influenced pedagogic transformation, though progress remains uneven across contexts. ICT tools such as computers, projectors, smartphones, internet platforms, and digital communication applications have expanded opportunities for interactive teaching, collaborative learning, and access to diverse educational resources. They have gradually shifted classroom practices from traditional teacher-centred approaches to more learner-centred and participatory methods. This transformation has been particularly evident in the use of video-mediated instruction, online sharing tools, and communication platforms that support continuous learning beyond the physical classroom. However, the effective adoption of ICT is constrained by challenges such as inadequate infrastructure, unstable electricity supply, limited internet access, insufficient teacher training, and weak policy implementation. Despite these barriers, ICT continues to offer strong potential for improving teaching and learning outcomes. Strengthening investment in infrastructure, teacher capacity building, and education-specific ICT policies is essential for sustaining meaningful pedagogic transformation in Cameroon's secondary education system.

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