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**Contact details:** The Editor, AJTE, [wendy.fox-turnbull@waikato.ac.nz](mailto:wendy.fox-turnbull@waikato.ac.nz)

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# Innovations in technology education toward technological literacy – A study of two high schools in South Africa

P. Marthinisen and M.B. Luckay  
University of the Western Cape  
South Africa

## **Abstract**

*Over the past two decades, South Africa has emphasised the need for school learners to be technologically literate by the end of high school. Specifically, South Africa's Department of Education (2007) and the Department of Basic Education (2019) stated that it was critical for high school learners to be technologically literate by the end of their schooling. The inclusion of Technology as a subject within the South African education policy framework was considered an important innovation, an attempt at making the curriculum compatible with the skills needed of a globalised economy (Ankiewicz, 2020). Given this context, the goal for teaching Technology as a school subject should enable both learners and teachers to acquire skills, values, knowledge, and attitudes to become critical and creative thinkers and developers. There is a need to continuously explore ways to promote the effective teaching and learning of Technology at high school level.*

*This study explores the teachers' adoption of ICT into the teaching of the school subject Technology in two Cape Town high schools. The theoretical framework drawn on in this study is the RAT model (Hughes et al., 2006), which helps in the understanding of an individual learners' and teachers' personal experiences of teaching, and understanding technology's role in teaching, learning, and curricular practices. The study explores the presence or absence of ICT adoption and utilisation in the teaching of Technology, as well as techniques that were applied within pedagogical practices.*

*The research design was a multiple case study at the two schools in the Province of the Western Cape. A qualitative approach was used to collect and analyse the data. Semi-structured interviews with both the Grade 9 learners and teachers were conducted. Focus group discussions were conducted with the learners at the selected high schools, herein referred to as School A and School B. Based on the findings, recommendations will be disseminated to the Department of Basic Education in raising the learners' levels of technological literacy through innovative teaching and learning strategies.*

## **Keywords**

Technology; technology literacy; technology education; subject technology; technology teaching and learning

## **Introduction**

Since the onset of the COVID-19 pandemic, there have been rapid technological developments that have led to significant changes in the way we interact with one another in environments where we live, work, and socialise. In the face of these changes, schools as educational institutions had to embrace pedagogical innovations in a meaningful way to adapt to the emerging complexity. The post COVID-19 changes have led to technological advances that required transforming classroom learning environments emerging as strong transformative drivers for change in the school context. The notion of creating new frontiers for schools through ICT adoption into classroom practice speaks to discarding restraints set in the past (Mhlanga & Moloji, 2020), narrowing historical disparities by benchmarking (Mhlongo et al., 2017), encouraging participation through access and inclusion (Dutton, 2004; Greta & Ove, 2018; Ankiewicz, 2018), promoting agile practices, and attention being paid to social justice in teaching and learning. Indeed, the South African schooling landscape promoted digital transformation to narrow the socio-economic divide between learners from historically advantaged and disadvantaged backgrounds, give equal access to knowledge and skills, and promote participation of all, but also exposing differences in the uptake of digital transformation, through ICT integration, across contexts, which is highly supported by policy (Gumbo, 2019; Luckay, 2022). The ICT refers to the computers, software, networks, satellite links, and related systems that allow people to access, analyse, create, exchange, and use data, information, and knowledge in ways that were almost unimaginable (Indika, 2011). In this regard, ICT integration in education can be understood as

the extent to which information and communication technologies have been adopted into the school environment and the degree of impact on the school's organisation and pedagogies. The level of integration is determined by the interplay between infrastructure, teacher motivations, innovations and development of e-pedagogies. (Indika, 2011, p. 2)

Technology education is a result of the importance of technology in our society insofar as technology is used to advance the quality of life using knowledge, skills, values, and resources to meet people's needs and wants by developing practical solutions to problems, considering key scientific, economic, social, and ecological aspects (Lind et al., 2020).

In the past two decades, technology education has extended worldwide because of its potential to accelerate national development efforts and revolutionise societies (Hamid & Hashim, 2022). Simultaneously, there was huge growth in the use of ICT in education around the world (Barakabitze

et al., 2019). In South Africa, the two merged as a gamechanger for the country to integrate with the modern global economy. Existing evidence suggested that the use of ICT could be a sound means of expanding access to and improving the quality of technology secondary education in the short run in South Africa (Gumbo, 2019; Ankiewicz, 2020), and teachers are key (Hasse, 2017). As a result, there were increasing calls to incorporate technology literacy into the South African high school curriculum as an important means of increasing the chances of success for learners once they entered tertiary institutions. Given the educational terrain, which is still influenced by the inequalities of the legacy of Apartheid, understanding how the teaching of Technology as a school subject could be enhanced becomes increasingly important (Chigona & Chigona, 2010; Chigona et al., 2014; Jantjies & Joy, 2016). The problem has been greater in previously disadvantaged communities (Amnesty International, 2020). While much of the above have been opportunities for teachers to teach and learners to learn with ICT, there is a gap in the South African literature in ICT that teachers are using to support their teaching and learning in the school subject Technology to promote technological literacy. Hence, this study aims to fill this gap by providing information on what and how teachers are meaningfully using ICT in the Technology classroom. This study will analyse the extent to which the two selected schools have taken advantage of ICT in teaching Technology, and the perceived impact of such utilisation on technological literacy. An in-depth analysis of two case studies provides insights into the potential contribution of the use of ICT in the teaching and learning of the Technology subject. Outcomes of this research are expected to guide teachers and policy-makers to contribute towards the effective teaching and learning of the subject at schools.

## **Background and rationale**

In 1994, a fragmented South African schooling education system was restructured, attempting to redress the educational imbalances; strengthen the links between teaching and research; align research with economic goals; and create environments for learners to “have access to quality education, and graduate with the relevant knowledge, competencies, skills and attributes that are required for any occupation and profession” (Council on Higher Education, 2000, 2016, 2017). The restructuring of the education system introduced a new subject, Technology, positioned differently over time, first as Science and Technology, and later only Technology, but no matter how it is positioned, the school subject Technology is different to Science and other subjects as it deals more with design, which requires skills important to how learners think and interact with technology (Collier-Reed, 2006, Gumbo 2019). Innovative pedagogies using ICT were promoted to enhance the teaching of the design process (Gumbo, 2019). However, the South African research evidence suggests that the adoption of ICT in schools has still not met expectations (Howie & Blignaut, 2009; Chigona & Chigona, 2010; Jantjies & Joy, 2016), and even when implemented, learners use the available technologies for entertainment on social media and not for learning. Mhlanga and Moloji (2020) opine that the pandemic has acted as a driving force towards digital transformation in the education sector, promoting the use of Microsoft Teams, Zoom, Skype, WhatsApp groups, Facebook, and Twitter corroborated by Okuntade et al. (2022). Teachers are themselves unable to promote the meaningful adoption of ICT, as their levels of technological literacy is very likely too basic to expose learners to the full benefits of the use of technologies in the classroom (Hasse, 2017). Moreover, investments have sometimes been made without a clear educational objective, and teachers have not been sufficiently included in the process. This suggests that simply investing financially into ICT for schools does not necessarily lead to the required changes in teaching and learning practices (Chigona et al., 2014). Notwithstanding, while there was a widespread adoption of hybrid teaching and learning models and online modes of school communication, the inequalities in

South African education are the persistent digital divide, differentiated access to resources, and connectivity. Indeed, these continue to present increasing challenges for an ill-prepared South African school sector, the pandemic further divided an inequitable educational system (Amin & Ramrathan, 2009; Pelletier et al., 2021). Therefore, the significance of this research is that it will contribute towards enhancing the teaching of the school subject Technology at high schools and inform policy.

## **Aims, objectives and research questions**

The overall aim of this study was to explore, describe, analyse, and compare how ICT, as pedagogical tools, were used in the teaching of the school subject Technology. The research objective:

- To explore the adoption of ICT into the subject Technology at two Grade 9 high schools in Cape Town, Western Cape.

The study will therefore seek to answer the following main research question:

1. To what extent do Grade 9 teachers' levels of technological literacy influence their adoption of ICT in the teaching and learning of the school subject Technology?

Sub-questions

- 1a. Does access to ICT support teachers' uptake of technological practices in the Grade 9 Technology classroom?
- 1b. How frequently do teachers promote technological literacy by using ICT when teaching Technology?
- 1c. How diverse is the use of ICT to promote technological literacy when teaching Technology?

## **Literature review and theoretical framework**

Tondeur et al. (2007) noted that research conducted globally revealed that utilisation of information communication technologies (ICT) in education was a catalyst to promote and drive the acquisition of knowledge in learners, empowering them for lifelong learning. Teachers play a pivotal role in the adoption of ICT to transform a classroom learning environment (Clausen, 2007; Ajayi, 2009; Hasse, 2017). Technology teachers are often anxious to use ICT in their classrooms because of the fear of the unknown or that they will make mistakes (Kimmons, 2019; Hardman et al., 2020). There needs to be constant updating of the ICT and the subject Technology teaching skills, whereby some teachers embrace it and others do not. For example, Gumbo (2019) emphasises that many teachers are comfortable demonstrating a simple circuit with a bulb, battery, switch, and wires. This can be demonstrated using ICT printed circuit boards, yet teachers will not use it because they have to be trained or learn to do it. Another example, according to Gumbo (2019) is the use of glue guns; the electronic versions can be used to teach about adhesives (a branch of polymer technology), but teachers tend to use it to teach about how the gun is used—switching it on and off. This implies that teachers are not adopting ICT meaningfully in their classrooms.

In order to promote meaningful teaching and learning with ICT, their own ICT adoption should be commensurate with their levels of technological literacy. If a teacher adopts ICT and takes on a more simplistic approach to the use of the ICT for teaching, then they use it superficially in the pedagogical process, limiting meaningful learning for the learner, and vice versa (Luckay, 2021). It can be argued

that the more teachers expose learners to ICT to promote meaningful learning, then they promote the learners' confidence in using ICT and thus their levels of technological literacy. Notwithstanding, ICT would contribute towards Technology Education and enhance technological literacy by giving learners in the Technology classroom opportunities to develop and apply specific design skills to solve technological problems; understand the concepts and knowledge used in technology education and use them responsibly and purposefully; and appreciate the interaction between people's values and attitudes, technology, society, and the environment (Gumbo, 2019). Additionally, learners would gain an idea of the way, for instance, engineers apply scientific principles to practical problems (Mlambo et al., 2020). Indeed, innovations that the ICT bring to the classroom in the form of media literacy, ICT literacy, digital scholarship, scholarly communications, and online collaboration in an academic context promote their technological literacy, directly impacting how they think and interact with technology (Collier-Reed, 2006, Hasse, 2017). This should encourage learners to actively participate in digital networks, use digital platforms ethically for learning and research, use digital tools and applications, navigate the e-learning environment, and participate in emerging academic and research practices in a digital environment. The incorporation of web tools, such as social media, Google, WhatsApp, and other applications are considered as value-added services, or value adding applications, to increase the visibility of their academic pursuits, communicate with others, and market the school (Mhlanga & Moloji, 2020).

This study used the Technology as Replacement, Technology as Amplification, and Technology as Transformation (RAT) Model (Hughes et al., 2006) to understand the use of information and communication technology in the teaching of the subject Technology at the two case study schools. The RAT is an assessment framework for understanding technology's role in teaching, learning, and curricular practices. The model is drawn from the view that technology is used as a means to some pedagogical and curricular end, that acknowledges the specific and unique motivation (Hughes et al., 2006) underlying a teacher's choice to use technology. Looking deeper to what end technology serves rather than simply focusing on the variety and number of software programs teachers use, would yield representations of teachers' technology use more accurately. The model introduced by Hughes et al. (2006) helped us to understand whether digital technology was functioning as replacement, amplification, or transformation in educational practice.

Technology as Replacement refers to a situation where technology is used to replace, but in no way change, established instructional practices, learners learning processes, or content goals. The technology serves merely as a different (digital) means to the same instructional end. Technology as Amplification shows an understanding that technology increases efficiency, effectiveness, and productivity of instructional practices, learners learning processes, or content goals. The tasks stay fundamentally the same while the technology extends our capabilities in effectiveness or streamlining. Technology as Transformation involves technology use that transforms the instructional method, the learners' learning processes, and/or the actual subject matter (Hughes et al., 2011). For example, new cognitive forms could emerge, new people could be involved, or new content might be accessible.

In this regard, technology serves a pedagogical or curricular role in the classroom. The RAT model seeks to identify that role and to make it explicit. RAT particularly focuses on what role technologies used in the classroom settings are fulfilling, conceivably making it applicable to any artefact used in a classroom context, be it digital or analogue (Kimmons, et al., 2015, 2016, 2017, 2019). The model is particularly important for high school teachers to determine where they fall within the RAT framework in terms of integrating information and communication technology in the classroom, and in the context of this study, in the subject Technology.

## Research methodology

The methodological approach used for this study was a qualitative approach. A multiple case study design was considered most relevant for this research. Ordinarily, a case study would provide a holistic, in-depth investigation by using multiple sources of data (Heale & Twycross, 2018) and is multi-perspectival in nature. Utilisation of the case study strategy also facilitated data triangulation by accessing multiple sources of data to understand the influence of ICT in technology literacy in the selected schools. A sample of four teachers who taught the Grade 9 classes were probed at two high schools to explore ways in which ICT were integrated into the teaching of the subject Technology. Two teachers' classroom practices were examined at each school. The two schools were resourced differently, one fairly well-resourced and classified as a high socio-economic status (SES) school, and in contrast, the other school, not well-resourced and classified as a low SES school. School A was highly resourced due to the high school fees which funded ICT resources. The school's vision was to promote the integration of ICTs into classroom practice and management supported these efforts by upskilling staff in ICT training. School B, on the other hand, being a lower SES school, evidently had less ICT resources and minimal management support with ICT integration. School B did not have a comprehensive school ICT policy plan and struggled to secure qualified Technology teachers. More than half of the staff complement of School B were, generally, "older" teachers, who claimed that they "cannot utilise technology".

The data collection methods used in this research included in-depth semi-structured interviews with teachers, focus group interviews with learners, and classroom observations of teachers teaching in their classrooms. Teachers were interviewed face-to-face at School A and School B. Four teachers' experiences at the two schools, namely, at School A (Teacher A1 and Teacher A2) and at School B (Teacher B1 and Teacher B2) are unpacked. The teachers were purposively selected because they taught the subject Technology to the Grade 9 classes. They played an important role in giving insight to their pedagogical strategies within their teaching contexts. The four Grade 9 teachers (3 males and one female) ranged in age between 33–48 years old (Table 1). All the teachers used ICT in their classroom practices to varying degrees. Data were collected through semi-structured interviews from the teachers, focus group interviews from the learners and classroom observations of the teachers to triangulate the interview data. The responses from the participants were audio-recorded and field notes were taken during the observation periods. This study reports on both the semi-structured interview data, focus group interviews and the observational data. The Grade 9 teachers were coded for anonymity, Teachers A1, A2, B1, B2. It was evident that the ages of the interviewed teachers suggest that they were born before ICT resources were available in the high schools.

**Table 1. Participant Codes That Were Used to Protect the Identity of the Participants**

Teacher	Gender	Age	Years of teaching experience	Use of technology
A1	F	33	7	Yes
A2	M	38	15	Yes
B1	M	46	10	Yes
B2	M	48	28	Limited

Learner codes were used to maintain the anonymity of the interviewed learners. These were labelled from Learner 1 (L1) to Learner 40 (L40). The focus group discussions with groups of learners of 10 per

group in both schools were conducted to triangulate both the interview data. All the participants responded in the focus group interviews, with 10 learners in 4 groups, coded FG 1 – FG 4. Focus groups facilitated observation of group dynamics, discussion, and clear insights into the participants' behaviours, attitudes, and language. The response rates were 100% for both the interview and focus group data, thus were sufficient to analyse and interpret the data, ensuring validity and reliability of the data. This study reported on three data sources, namely, the semi-structured interviews with the teachers, focus group interviews with the learners, and classroom observations of the four teachers.

According to Abrar and Sidik (2019), ethics is the principle of right and wrong, influencing the researchers conduct during the research process. The research was conducted following ethical approval from both the university and schools. The participants were aware that participation was voluntary, anonymous, beneficent, confidential, and they could withdraw at any time. Further, the researchers ensured that informed consent was observed and signed.

According to Sharma (2018), data analysis refers to the process of bringing order, structure, and meaning to any collected data. In the qualitative context of the study, content analysis was used to analyse the data. The researcher developed categories of responses based on the themes that emerged and then counted the frequency of instances when those categories occurred. The analysed data was drawn from the data collected. In line with the RAT model, analysis focused on how technology served as a different (digital) means to the same instructional end (Replacement); how technology was being used to increase efficiency, effectiveness, and productivity of instructional practices and learners learning processes (Amplification); as well as how transformation of the enhancement of technology would allow teachers and learners to improve knowledge transfer and acquisition as well as expand ICT skills (Transformation) (Hughes et al., 2006). Overall, reference to the RAT model enabled analysis of how ICT was regularly embedded into the classroom environment.

## Results and discussion

This research focused on teachers' use of ICT in Grade 9 at two high schools in the Western Cape.

The main themes from the study are as follows:

- Theme 1: Usage access to adopt ICT in classroom practice
- Theme 2: The frequency of ICT usage in the classroom in the subject Technology
- Theme 3: The diversity of ICT usage in the classroom in the subject Technology

Each theme was unpacked and described with detailed sub-themes in Table 2.

**Table 2. Major Themes Usage Access, Frequency, and Diversity of ICT**

Theme	Theme	Sub-theme
Theme 1	Usage access	Access to resources
Theme 2	The frequency of ICT usage in the classroom in the subject Technology	Computers Laptops Mobile phones
Theme 3	The diversity of ICT usage in the classroom in the subject Technology	Internet Class presentations Marking and Tests Preparing Notes Spreadsheets



		Communication Loading e-books
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Table 2 shows Theme 1 (Usage access) and Themes 2 & 3 (Usage frequency and Usage diversity), together with the sub-themes, and these will be analysed and discussed under the theme headings, namely, *Usage access (Theme 1)*, *Usage frequency*, and *Usage diversity (Themes 2 & 3)*.

## Theme 1: Usage access

The access to ICT's in the two schools varied, with School A having better access to technological resources in the form of ICT resources, ICT budgets, and ICT teachers' skills, than School B. It was evident from observations that School A had access to financial resources, mainly because of the higher SES, high fees, and access to additional funding from the parent community. The school's vision was to promote the integration of ICT into classroom practice and plans were put in place by management to support classroom practice. Indeed, staff in School A were upskilled through training, the school had developed policies to support teachers in the classroom, classes were equipped with key ICT, and technological tools and learners were supported in classroom practice through access to a variety of digital technologies. A study by Yildirim (2007) found that access to technological resources is one of the effective ways to support teachers' pedagogical use of ICT in teaching.

School B, on the other hand, being a lower SES school, evidently had less technological resources in the form of ICT resources, ICT budgets, and ICT teachers' skills than School A. Moreover, School B did not have a comprehensive school ICT policy plan, which was supported by school management, like School A. Additionally, School B also struggled to attract qualified teachers who could teach the subject Technology and was further challenged by the fact that more than half of their teachers were "older" teachers. Consequently, learners at School B generally claimed in interviews that these "older teachers" "cannot utilise technology". This finding corroborates the study of Gudmundsdottir (2010), who found that a digital divide existed between differently resourced schools in Cape Town, and a renewed policy focus should be adopted to minimise inequality amongst schools. This implies that there should be strong policy frameworks to direct ICT integration, aligned to support variable school contexts and teachers' pedagogical practices within these contexts. Janssen et al. (2019) maintain that "successful use of ICT in the classroom requires thoughtful integration of technology and pedagogical processes during lesson preparation" (p. 115). That means that it is necessary that teachers explicate and reflect (Schön 1983) on the specific methods and tools they include in planned lessons so that complex demands of ICT integration in teaching and learning are appropriately addressed (König et al., 2022).

It was evident that the usage access between School A and School B varied. In School A, access to ICT and pedagogical access in the classroom was driven mainly by human capacity and training by the teachers and less by resource availability. On the other hand, in School B, the usage access to ICT and pedagogical access was due to a combination of the resource availability and teachers' pedagogical access, given that teachers in School B were older and were not qualified to teach the subject. Buabeng-Andoh (2012) reviewed literature and found that teacher-level, school-level, and system-level factors prevent teachers from ICT use. These barriers include lack of teacher ICT skills, lack of teacher confidence, lack of pedagogical teacher training, lack of suitable educational software, limited access to ICT, rigid structure of traditional education systems, restrictive curricula, etc. (Clausen, 2007; Chen, 2008; Tondeur et al., 2008; Lim & Chai, 2008). These factors require further investigation in this study. It was evident from the interviews and classroom observations that the usage frequency and usage diversity in Schools A and B varied. These were explored and unpacked in the theme's usage frequency

and usage diversity below. The diversity of ICT used in both schools was limited to two technologies, namely, computers and mobile phones. The diversity of usage ranged from using the Internet, class presentations, preparing notes, marking and tests, spreadsheets, communication, and loading e-books. Mobile phones were primarily used for Internet and YouTube searches, WhatsApp communication, and as a calculator or dictionary. The themes usage access, usage frequency, and usage diversity overlapped and were difficult to discuss as isolated themes. This finding corroborates Mhlanga and Moloi's (2020) and Hameed and Hashim's (2022) findings on the usage frequency of technology, namely, that the excessive use of social media did not necessarily promote meaningful learning. Hence, these three themes are outlined below, drawing on pedagogical implications of the adoption of ICT into classroom practice.

Overall, the results in this theme suggest that for Technology teachers to successfully integrate ICT into their teaching, social context (SES) matters—related to personal, institutional, and technological factors (Buabeng-Andoh, 2012). On the personal level, there should be acceptance of the usefulness of technology and its integration into teaching (Huang & Liaw, 2005) and the teacher must be willing to accept the practice aligned to their personal beliefs (Buabeng-Andoh, 2012; König et al., 2022). At the school level, professional development is a key factor to successful integration of computers into classroom teaching. The ICT-related training programmes develop teachers' competences in computer use (Bauer & Kenton, 2005; Franklin, 2007; Wozney et al., 2006). Factors outside of the school, like school fees and ICT resource availability, can expose teachers to ICT at school, motivating them to use ICT in classroom practice. Further research is required at each of these levels in South Africa.

## Themes 2 & 3: The frequency and diversity of ICT usage in the classroom in the subject Technology

It was evident that the teachers in both schools primarily and frequently used *Computers and Mobile Phones* during the teaching process, and the learners used these primarily to learn. These technological tools were used more frequently in School A, given the infrastructural and managerial support inside and outside the classroom, while the teachers in School B often would not use ICT because of their own capability limitations and their perceived lack of infrastructural and managerial support. All the teachers interviewed used the ICT as administrative tools, mainly to record grades, calculate averages, manage attendance, and access data on learners in the subject Technology. The classroom observations verified that they adopted ICT into their classroom practice superficially and showed that teacher activity and student groupings/interaction patterns resulted in the majority of classroom time being devoted to teacher-directed, whole group instruction rather than the student-directed, interactive, peer-to-peer interaction. Locally, Luckay (2021, 2022) found that teachers' basic level of technological literacy often let them use digital tools superficially when teaching. There is, therefore, an urgent need for teachers of the subject Technology in Schools A and B to provide opportunities for their learners to make full use of a range of ICT-related pedagogies for learning, in particular, those that promote deeper learning. These findings corroborate international studies showing how teachers are heavily challenged to deal with the ICT transformation process at school (Ajayi, 2009, Tondeur et al. 2017; König et al., 2020). This would drive the teachers to teach more conceptually according to the constructivist theory, and for teachers to make teaching more pedagogically engaging, which would support the highest level of utilisation according to the RAT model, instead of the superficial adoption of ICT into the pedagogy (Hughes et al., 2006). The innovations that ICT can bring to a classroom to allow learners to actively participate in digital networks, use digital platforms ethically for learning and research, use digital tools and applications, navigate the e-learning environment, and participate in emerging academic and

research practices in a digital environment are overshadowed by the superficial use of computers and mobile phones as administrative tools. This response was evident from the teacher interview responses at both schools, for instance, Teacher A2 claimed:

Once you have everything on the computer, then next year you can just add a few things. If you think about that, it drastically reduces your workload for the next year if you are teaching the same subject and you have that stuff already on your computer.

Teachers noted that they also opened or downloaded YouTube videos that were used for additional learning purposes in class. Teacher B1 stated: “I use additional videos for enhancing learner understanding of the subject because they contain visuals.” Teacher B2 argued: “YouTube gives me current information on the subject which is helpful to acquisition of knowledge.” Regarding the computer, all teachers interviewed noted that they also connected to a multimedia projector and did slide presentations. In order to prevent learners from disengaging, one of the teachers (Teacher A1) reported that they avoided using slide presentations entirely made up of text and included multimedia elements to effectively hold the attention of learners by varying content delivery. These elements included images, graphs, pictographs, sound effects, and short video lessons. Some of the graphs and pictographs were easily available on the Internet but where there was a need the teachers produced some themselves. All teachers argued that adding different kinds of media could make slides more engaging. This finding corroborates the findings of Hardman et al. (2020) and Hameed and Hashim (2022). While this finding is important, more subject-specific foci have hardly been accounted for in literature (König et al., 2021), especially in the Technology subject, which also could be strengthened in future research focusing on using ICT lesson planning, with a focus on pedagogy.

All the teachers conveyed the benefits of ICT adoption for learners, oblivious of their lack of meaningful pedagogic engagement with the learners using ICT. In order to maintain learners’ concentration, the teachers highlighted that they used the computer to undertake a variety of activities. For example, they used the computer for audio-visual education. This helped learners to learn faster and easily which was important for the subject Technology. According to the teachers (A-B), this made learners enjoy what they were learning and achieved a high level of concentration. Visual illustration using images on projectors tended to enhance understanding of key concepts by learners because they were fascinated by images, some of which looked familiar to a learner. Arbugarni and Ahmed (2015) found similar findings in their study on success factors for the implementation of ICT in Saudi Arabia and Altun (2007) found this finding in Turkey.

Learners felt motivated when teachers adopted ICT-related pedagogical approaches. One of the learners (Learner 6) indicated: “For me it’s hard to memorise stuff but I like to memorise stuff. I like pictures.” Another (Learner 11) said: “I gain more knowledge of the drawings than of the theory.” When asked about the benefits of these, a learner argued: “It make us interested because he uses slides and shows us videos of different types of technology things.” Another learner commented on the use of media: “It keeps the learner more like captive into ... like captivated into the lesson. It makes them interested.” This result corroborates the studies of Grabe and Grabe (2007), who stated that ICT utilisation plays a crucial role in learners’ skills, motivation, and knowledge. Moreover, all focus group interviews corroborated this narrative amongst the learners, as they claimed that they did not want to read text continuously for long lengths of time; therefore, the introduction of audio-visual technology in the subject Technology classroom made them enjoy what they were learning. This result corroborates Guido’s (2017) research conclusions that utilisation of ICT positively impacts on a learner’s

development in numerous competence areas that include memory, creativity, critical thinking, and problem solving.

## Conclusion

It is evident that the school subject Technology subject teachers adopt ICT as a replacement according to the RAT model, which refers to a situation where technology is used to replace, but in no way change, established instructional practices, learners learning processes, or content goals (Hughes et al., 2006). The technology (ICT) serves merely as a different (digital) means to replace the same instructional method, such as note-taking, answering pre-defined questions, and completing chapter and unit tests, instead of using ICT to design authentically engaging, complex tasks for learners. This finding is in line with other studies elsewhere that have found that teachers lack ICT competence, which means that they cannot act as competent mentors for their students (Judge & O'Bannon, 2008). Further, Aduwa-Ogiegbaen (2014) argues that in Africa, the majority of teachers lack essential technological knowledge and need extensive professional development to apply ICT in teaching. Thus, there is an urgent need for teachers of the subject Technology to provide opportunities for their learners to make full use of a range of ICTs for learning, in particular those that promote deeper learning (Luckay, 2022). Although this study suggests that there is general interest to promote ICT adoption in the teaching of Technology as a subject to promote literacy, uneven distribution and availability of robust technological infrastructures and networks at the two schools consequently led to the schools not being in a position to effectively promote the use of a wide range of technologies to develop information, media, and technology skills, similar to the findings of Gudmundsdottir (2010), which implies that there was limited progress in this regard. In view of the fact that technological infrastructure and availability is still limited, systemic solutions to rolling out the training to teachers must be sought.

One of the key changes that teachers should implement in order to facilitate the adoption of ICTs into classroom practice is through developing a social constructivist learning environment. Teachers should facilitate rather than dominate in classroom practice when creating such an environment. One of the key features of such a learning environment is collaboration amongst learners. A good quality communicative atmosphere in the classroom, where learners can foster active engagement, use language as a tool for such communication, generate ideas, develop a critical voice amongst the learners, and support each other's learning can open up opportunities for teachers to use ICTs in the classroom (Kimmons et al., 2015; Leopoldina et al., 2019; Hameed & Hashim, 2022). If students are likely to explain and discuss their ideas, then they are more likely to generate cognitive ideas and promote creativity in classroom practice. The reception of creativity would allow teachers to develop lessons to feed learners' engagement with knowledge, and hence the use of ICTs can guide learners' thinking, especially in the design process within the subject Technology curriculum.

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