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Research Article

Educator's perceptions and influences regarding ICT Integration into teaching and learning in Gauteng Public Schools

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Abstract

The study is an extract from the researcher's PHD thesis titled, "Pedagogical Integration of Technology as an enhancement to teaching and learning in Gauteng Public Schools". The study aimed to explore the degree of the ICT integration within Gauteng Public Schools, the challenges impeding the optimum utilisation of ICT towards curriculum delivery and enabling conditions for ICT rollout in education transformation. Therefore, the study's objectives were to determine the degree to which individual qualities impact the educator's preparedness in using ICT for teaching, to ascertain the magnitude preceding ICT skills and computer training affects educators' preparedness within their teaching environment.

The study was hinged upon a pragmatist paradigm, using mixed methods approach, whereby a case study was chosen as a strategy. The theoretical notation for the study was an inductive simultaneous approach whereby the qualitative dimension was core and quantitate dimension was supplemental. Purposive sampling technique was applied to sample twelve (12) Heads of Departments (HODs) and five (5) senior officials from the Gauteng Department of Education (GDE). Both educators and HODs were selected from public schools in three Gauteng regions: Johannesburg, Tshwane, and Ekurhuleni. Furthermore, a stratified random sampling method was used to obtain feedback from two hundred and ten (210) educators, who were selected from the identified population.

The study findings showed that male educators had a higher and positive attitude towards ICT integration and utilisation in the classroom than their female counterparts. In addition, the study findings revealed that most of the professional development support from the department provided to educators mainly empowers them on how to best utilise information communication technology available, not how to effectively integrate the technology into the curriculum.

The results of this study confirmed that even though resources and training were provided by the GDE, educators were not sufficiently equipped to develop their own approaches that could embrace ICT into the learning process. In most cases, educators were not using technological tools to develop their lesson plans and curriculum delivery. A clear understanding of how educators integrate ICT in teaching is significant to develop and deliver effective educational opportunities to properly prepare learners for higher learning, work, and life in the 21st century.

Keywords: Curriculum Delivery; Educators' perceptions; ICT Integration; Pedagogy; Self-efficacy

Introduction

Globally, societies and governments have embraced the importance and critical role played by ICT in terms of economic advancement, political stability and human resource development (Adelabu & Adu, 2015:306). In view of the above, different disciplines and sectors continually compete to be at the cutting edge of technological innovation and ideation (Dunn & Rakes, 2010;Costa, 2021).The ambitions and aims for the use of ICTs in the public sector are vast, both in terms of efficiency and effectiveness, as well as the reinforcement of democratic functions. Realizing such a diverse variety of goals necessitates a diversified number of tools and measurements (Jansen, 2012).It was for this reason that the Department of Basic Education (DBE) in South Africa formed a collaboration with several commercial enterprises and non-governmental organizations (NGOs) in order to bridge the digital divide between schools in the nation as a result of recognition of the value of ICT in education (DBE, 2004).

Furthermore, the DBE published the White Paper on e-Education in, as far back as 2004, as part of its strategy to incorporate ICT into teaching and learning with the idea that it would serve as the official governing policy (RSA, 2004:17). The e-Education Policy was published with the intention of fostering and expanding access to fair educational opportunities and delivering individualized learning experiences (DBE, 2014). This was implemented to "guarantee that every school manager, educator, and learner in the general and further education and training bands, will be ICT capable," according to the policy's strategic objective (RSA, 2004:17).

Gauteng Province has been at the forefront of digital transformation in schools, prioritising public schools in general and township schools in particular(Ntsobi, 2021). Therefore, as stated by Bladergroen, Chigona, Bytheway, Cox, Dumas, and van Zyl (2012:107), the implementation of educational innovation through the integration of ICT in teaching and learning is deemed as critical and pivotal in terms of economic advancement and people development in Gauteng Province. Policy makers in the education department are also aware that the success of ICT integration is predicated on the teachers' technological proficiency in the efficient use of ICTs (Van den Berg, 2017). The paper presents an account of challenges and opportunities related to integration of ICT with teaching and learning in the schooling system within Gauteng Province in South Africa. It seeks to answer the following questions:

- What are the challenges of ICT integration in teaching and learning in the Secondary Schools in Gauteng Province?
- What is the state of preparedness of educators to integrate technology in curriculum delivery?

Methods

This inquiry was hinged upon pragmatism philosophy, employing the use of case study and survey as a research strategy within the mixed method tradition (Schoonenboom & Johnson, 2017). Using a Qual+quan theoretical approach (Johnson & Christensen, 2017), the qualitative dimension used a case study (Heale & Twycross, 2018) while the quantitative dimension used a survey (Ponto, 2015). While case studies focus on a small sample of people, surveys frequently take samples from a large number of people. The purpose of gathering information from a large number of people is to draw conclusions about the subject being studied. Johnson, Christensen, and Turner (2014) claim that surveys get comparable data from a named population (Johnson, et al. 2014). A selection of randomly chosen public schools in Gauteng served as the study's subjects. The study's schools were randomly selected for a sample by the researcher. Based on the time allotted for doing the research and how easily accessible the schools were, the researcher selected a sample of the schools.

In Gauteng public schools in South Africa, the target population for the study was educators. Two hundred and twenty-seven (227) education professionals were chosen as a sample size, which was deemed sufficient for the study. The questionnaire served as the primary research tool for the study and was used to gather data and opinions on the usage of ICTs in public schools in Gauteng to improve teaching and learning procedures (Guest, 2013). The five-point Likert Scale was used in the questionnaire to record replies (Likert, 1932). Strongly agree, agree, neutral, disagree, and strongly disagree are among the options on the scale. Strongly agree was given a value of 5, while strongly disagree was at the other extreme and given a value of 1. The surveys were delivered to the participants by the researcher in person. Before the study began, a letter of fieldwork authorisation was obtained from the Gauteng Department of Education (GDE). Before the questionnaires were provided to the study participants, they received a thorough debriefing on the study's

goals and objectives. In order to allay any potential concerns regarding the questionnaire or any other component of the study, great care was taken to properly clarify every question on the questionnaire.

Findings

The paper is made up of 9 key sections, providing an in-depth perspective of previously reviewed literature on the phenomenon.

Influence of age on educators' preparedness to use technology in teaching

The age of educators influences their preparedness as indicated from the findings in which most of the respondents agreed that age influences educators' preparedness to use ICT. This implies that old educators are relatively not ready to adapt to the 4th generation industrial revolution (4IR), which embraces ICT and they prefer to use the old models of teaching. It is evident from the findings that the younger age group of educators prefers using technology. The reason being that they are always eager to learn about new technological advancements and from their knowledge, they are quite aware of the positive effects of adapting to changes of technology. In addition, the results also indicate that young educators are very quick at adapting to ICT and are happy to use technology as it amplifies the teaching process.

Veenhof, Clermont and Sciadas (2005) argued that there are a lot of older employees that do not possess ICT skills; hence this might affect their demand and competence at work. As such, their study concluded that a substantial deterioration in ICT use has been observed mostly after the age of 45 in a lot of different workplaces. Conversely, those respondents who did not agree suggested that people can adapt to changes in technology despite their age. The study also made a case for the introduction of change management early in the ICT rollout process.

Influence of gender on educators 'preparedness to use ICT in teaching

The results clearly indicate that gender influences educators' preparedness to use ICT in teaching as confirmed by the respondents. The use of information communication technology is more prevalent in male educators than in female educators. The reasons why male educators are more prepared to use ICT in teaching include the following, ranked according to the percentage of respondents: males are experimental; males have more time; males have more access to computers and males can multitask better. In addition, the results indicate that female educators are shyer when it comes to ICT usage in teaching while male educators are very fast at adopting new ICT developments. Moreover, they are prepared to utilise ICT in teaching. Also, the findings showed that female educators are not fully prepared to utilise ICT in teaching. The irony though was that the study found out that most ICT Champions in Gauteng schools were female (Ntsobi, 2021).

According to Khan and Markauskaite (2017), the introduction of ICT into the education sector created new social stereotypes and gender inequalities and ever since computers were invented, there was a lot more participation in ICT related activities by men than women. As such, it was also noted that there was a high difference in gender participation in ICT activities, within technological and mathematics-oriented disciplines in schools (Khan & Markauskaite, 2017).

Most (62%) of the respondents suggested male educators while a small number (38%) of the respondents suggested female educators as the gender that is more prepared to utilise ICT in teaching. Also, the findings observed from the research are in line with the other study conducted by Shapka and Ferrari (2003), who suggested that males are mostly fascinated with ICT use than females; thus men are most likely to utilise computers in all the activities they are doing and have more positive attitude about computers and therefore, outdo their female counterparts in ICT skills. Furthermore, the study conducted by Khan and Markauskaite (2017) who investigated gender differences in self-reported ICT experiences and ICT literacy among first year graduate trainee educators concluded that significant differences between males and females in technical ICT capabilities, and situational and longitudinal sustainability play an important role which seen are males dominating and their scores were high (Khan & Markauskaite, 2017).

Moreover, the findings indicated that male educators are more experimental, and love using gadgets and further suggested that they have more time (Markauskaite, 2006). The results are in line with those of Jamieson-Proctor, Burnett, Finger and Watson (2006), who carried research on educators' integration of ICT in schools in Queensland State. The study concluded that female educators were integrating technology into their teaching less than male educators (Jamieson-Proctor, Burnett, Finger and Watson, 2006).

The results that male educators are more willing to integrate ICT's in teaching and learning compared to their female counterparts are in line with a conclusion drawn by Volman and Eck (2001) which showed that most women educators have been anxious, hence poorly experienced as well as less confident about their ICT competencies. As a result, most female educators do not like or use ICT for diverse teaching and learning reasons in the classroom. In addition, the results from the study contradict those by Adams (2015), which concluded that female educators utilise technology greater than men. The findings also indicate that most of the respondents agreed with the statement that male educators are quick at adopting new ICT developments, and female educators are not usually ready to adopt the new ICT developments because they lack enough time. From the results of the study, one could oppose the argument put forward by Yukseltturk and Bulut (2009) which established that there is reduction in gender gap in the previous years and currently, quite a number of women are using internet and web technology compared to the number of men.

Confidence in ability to integrate ICT in class

The findings indicate that 24% of the respondents were very confident about their ability to integrate technology in their daily tasks, especially when they are teaching whilst 47% of the respondents were confident about their ability to use technology when teaching in the classroom. Furthermore, 17.5% of the respondents were confident while 11.5% of the respondents were less confident. Overall, most of the respondents seemed to be confident about using technology in the daily routine work in the classroom. The implication of the results are that, improved attitude towards ICTs would enhance technological competence and preparedness amongst educators to integrate technology in their daily routine teaching. Reno, Brahma, Bidram, and Ropp, (2021) reported that learning and preparedness in computer use is aided by high levels of self-efficacy and a positive attitude. It is in view that the researcher sought to establish how educators feel about using ICT in teaching and learning.

Educators' self-efficacy can be a barricade against effective ICT utilisation as noted in the study by Bandura (2016). That study argued that self- efficacy is one's own belief in his or hercapability to complete a task. Therefore, to develop, conform or be confident with the utilisation of ICT resources, there is a need to go through various levels of training as well as practice. Therefore, Tsai, Chang, Kao and Shih-Chung (2015), argued that teachers that use a lot of ICT resources in their spare times develop a high level of confidence towards the ICT gadgets, hence they have high self-efficacy and become easily inspired, resulting in positive teaching outcomes in the classroom.

Majority (85.5%) of the respondents considered using technology in teaching. These findings are in line with those by Albirini (2016) who suggested that approach of the educators to the utilisation of technology plays a significant role in successful utilisation of technology in their daily classes and teachers' attitude usually act as an estimator of technology being accepted and utilised in the classroom and other teaching activities. Therefore, it is crucial for educators to have a positive attitude towards ICT as their attitude influences their preparedness to adopt ICT in curriculum delivery. In addition, the research sought to ascertain the ways in which ICT can be adopted and integrated in the classroom for teaching and learning. Educators can make use of ICT in making schemes of work; researching teaching topics or content; making or keeping records of work and making or keeping teaching notes.

Educators' attitude towards the use of ICT in teaching

The findings indicated that most (65%) of the respondents seemed to have a positive attitude towards the use of ICT in teaching whilst few respondents had a negative attitude. These findings concur with the sentiments by Reno, et al., (2021) who suggested that even though quite a number of teachers have positive attitude in the utilisation of technology, they do not have confidence in the usage of technology in the classroom with learners. Respondents suggested the following ways to change the attitude of educators towards ICT use in teaching: a need to expose educators to technology; seminars or workshops on ICT; incentives on the use of ICT and a need

to inform educators about benefits of using technology in conducting lessons.

These results are in line with those by Kay (2017) who contended that there should be comprehensive education reforms and policies that seek to adequately prepare the high school graduate learner for the dynamic "economic, workforce, and citizenship opportunities and demands of the 21st century". Consequently, for any meaningful changes to occur, Kay further argued, that the educators are the agents of that transformation hence the need for them to accept the change and align their teaching methods to new approaches to curriculum delivery influenced by technology (Park & Sung, 2013).

Moreover, Kareseva, Siibak, and Pruulmann-Vengerfeldt's (2015) study also supports the findings by Kay (2017). The former's findings are that educators with poor or low ICT self-efficacy have a tendency of rejecting integration of ICT for teaching and learning in the classroom. As a result, they have a high appetite to resist technological changes in their work skills. Also, Simin, Thanusha, Logeswary, Annreetha (2016) executed a study to assess educators' utilisation of computers in the classroom, beliefs, attitudes and training they received, and concluded that a negative attitude of teachers against ICT will negatively affect how they perceive the importance of ICT and its integration for teaching and learning in the classroom no matter how much training they can receive from government. Also, other studies addressed the issue of barriers teachers face towards utilising ICT in the classroom (Brinkerhoff, 2016; Hughes, 2015; Celik & Yesilyurt, 2013; Kreijins, Acker, Vemeulen and Buuren, 2013), which is also in line with current study results.

The results from the study showed the extent to which educators' belief system has a big influence in the manner in which a particular teacher will embrace ICT in his or her classroom as evidenced by similar studies by Ertmer & Koehler (2015), who attested that it is entirely the educator's decision on whether technology is used or not in the classroom and relies on the beliefs that educator has about that technology.

In addition, the study noted that skill, perceived knowledge, level of computer competency, training as well as experience, significantly influence how educators' attitudes and perception of the value and manner in which they will use ICT for teaching and learning in the classroom (Ghavifekr, & Rosdy, 2015; Kreijins, Van Acker, Vermeulen, & Van Buuren, 2013). The findings indicate that most female educators have a tendency of avoiding the utilisation of ICT for teaching and learning because it requires an understanding of how ICT gadgets work. They try to avoid embarrassing themselves in front of their learners hence their negative attitude towards it (Kay, 2015). These findings are in line with those of Kopcha (2010), who suggested that there is a likelihood that teachers with poor attitude towards ICT integration in the classroom will not plan and teach using ICT resources at all.

Influence of previous computer training and educators' preparedness to use ICT

The findings revealed that prior computer training as an important factor, which enables educators to acquire more knowledge on technology (52%) and faster coverage of the syllabus (12.5%). Finally, the results also indicated that prior computer training would increase an educator's confidence in the use of ICT. Tondeur et al. (2013) defined computer competence as the ability of handling various types of different computer application for various determinations. According to Bordbar & Mohammad (2017), educators' skills and knowledge of computers plays a great role in utilising technology in classrooms. It is evident from the findings that ICT training influences educators' preparedness to utilise ICT for teaching and learning. 44.5% of the respondents indicated that their computer skills were fair, 14% indicated that their skills were good, 10.5% cited very good skills while 8.5% indicated excellent computer skills.

Furthermore, the results pointed to the view that educators with prior computer knowledge are more confident in using ICT in the classroom and therefore conquer with sentiments by Knezek and Christensen (2016), who suggested that educators' capability with computer technology is a major determinant of real utilisation of technology in classrooms. Moreso, educators possessing adequate skills and knowledge of computers are likely to have much confidence in their capability to utilise computers successfully (Peralta & Costa, 2007).

Albion (2012) states that decisions made by educators about the use of computers in their classrooms are likely to be influenced the accessibility and availability of relevant software. Most (61%) of the respondents indicated that they do not have convenient access

to computers at home whilst few (39%) indicated that they do have convenient access to computers at home. These findings are in line with those of Dunn and Rakes (2010) who argued that the degree of technology acceptance delay by educators is influenced by quality of training the teachers receive towards improved ICT integration in the classroom and competence towards self-efficacy in ICT use for teachers. In addition, most (51.5%) of respondents indicated that they owned the computers, 25.5% cited they use cybercafé computers, 13.5% indicated using computers at school and 9.5% cited they use a friend or colleague's computers.

Respondents further agreed with the view that the inability to consistently access a computer will affect educators' preparedness; lack of internet connection affects educators' preparedness; lack of personal computers limits educators' use of ICT at home and the cost of buying personal computers negatively impacts on educators' preparedness. Moreover, the main ICT infrastructure challenge that educators face at home and at school include poor internet connectivity, lack of electricity and frequent electricity failure.

The findings indicated similar results from other researchers that female educators have been faced with a high level of low self-esteem towards the use of ICT in the classroom despite a lot of training they received from the government to prepare and equip them for teaching and learning using ICT (Lowther et al., 2016; Luterbach and Brown, 2011; Ahmad & Starkey, 2018). Educators are getting anxious and confused with the introduction of a variety of technologies to enhance teaching and learning (Kalemoglu Varol, 2015). Furthermore, the findings are also in line with the conclusion drawn by previous studies, which noted that the poor ICT integration in schools is primarily due to the barriers educators face, notably: skills levels and knowledge regarding pedagogical integration, access and time to use the technology as well as limited professional development and training (Hew & Brush, 2006; Kopcha, 2010).

The findings of the study were in line with those of Mburugu, Mulwa and Kyalo (2017) who found out that ICT equipment is a crucial requirement for educators' preparedness to adopt e-learning in curriculum delivery. For the schools to be able to make use of advanced technology purposively, they must acquire the necessary ICT equipment. These include computers, LCD projectors and mobile telephones, among others.

Furthermore, the findings revealed that ICT infrastructure can be improved to avoid any disruption caused by poor infrastructure. Most of the respondents (58%) stated that equipping schools with modern and appropriate technology could add value in enhancing the vision of providing ICT infrastructure in schools. These views were supported by further 19.5% who suggested a need for improving networking; while 22.5% of respondents suggested improvement of power supply for schools, including possible use of solar power, 19.5% cited improving networking, 15% cited electricity installation with standby generators and 7.5% cited solar powered computers. This implies that most of the respondents are fully aware that ICT infrastructure can be improved.

The findings indicated that most of the respondents (66.7%), suggested that educators were not using computers in lesson preparation whilst 33.3% of the respondents agreed that educators were using computers in lesson preparation. These findings implied that there is a need to encourage or motivate educators to use computers in lesson preparation, which will simplify the process. The results are in line with those of Inan and Lowther (2010) who state that there are diverse uses of ICT in schools and the main ones are: technology for instructional delivery, technology for instructional preparation as well as technology as a learning tool.

Regarding participation of educators in ESP-ICT project, the findings indicated that majority (75%) of the respondents suggested that educators were not participating in ESP-ICT project which is meant to enhance ICT knowledge and skills whilst, a few (25%) number of respondents did suggest that educators were participating. The findings are line with those by Dunn and Rakes (2016) who concluded that educators are anticipated to embrace ICT and various ICT oriented resources for teaching and learning. On the other hand, educators have been slow to embrace ICT hence integrate it into pedagogical practice. They further stated that there is poor utilisation of ICT in the classroom despite a full decade of awareness and training to teachers about the importance of ICT for teaching and learning in the classroom. The findings imply that there is need to develop a mechanism that will ensure that most of the educators participate in all ICT-related projects, which in turn equip them with skills and concepts that they can use in teaching.

The success of ICT rollout in Gauteng

From the study, the findings showed that majority (80%) of the respondents confirmed that the ICT roll out in Gauteng was a success whilst 20% of the respondents saw it as a failure. Considering these results, one could conclude that the department still has some work to do in closing the gaps on implementation, especially on infrastructure preparedness, security and onsite support.

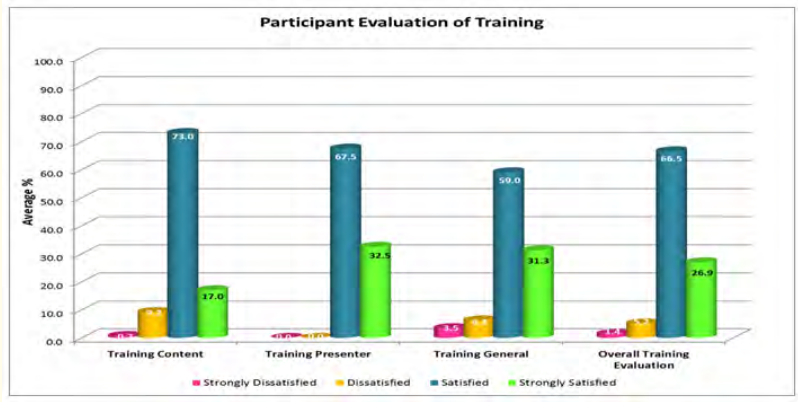

Figure 1: Participant evaluation of training.

Participant reaction to training programs across the province was satisfactory with an average of 81% of the teachers recommending the content for their peers. Gatsky's four level program evaluation model was utilised measuring participant reaction, content learnt through pre and post-test, organisational support as well as use of knowledge for teaching and learning. This demonstrates that the project was a success.

Furthermore, training and support was also offered to Subject Advisors who went through a nine-module course on ICT integration and a total of 325 teachers were trained. A handbook and an ICT Toolkit was developed to train District and School Based ICT committees. A total of 984 School Based ICT committee members were trained and 1200 teachers received professional development on the MG online platform.

This ensured that subject content was loaded on the site for that specific module. All the information would be easily accessed by the learners and educators respectively. Currently there are learning management and communication platforms, in school servers and stand-alone applications. The other form is through the learner management system (LMS) which also incorporates learner attendance module. The LMS includes learner assistance programme which is more practical where learners can interact with educators on assignments and subject specific matters. The impact on learning outcomes is that schools are able to close learning deficiencies.

Integration of ICT in teaching requires enough ICT facilities, for instance, classroom, educator and learner devices. Educators should have access to devices to expand their knowledge, hence facilitate its integration in teaching. The findings from the study indicated that most (99%) educators in full ICT and targeted schools for the ICT rollout have the necessary resources. From these findings, one could suggest that this phase of the rollout was a success.

Furthermore, the researcher sought to find out educators' views on ICT infrastructure and its preparedness for ICT use. Most of the respondents raised several aspects that derail integration of ICT in teaching. It was indicated by average mean score of above 3. In addition, the respondents also suggested that unreliability of internet connection affects educators' preparedness to use ICT, with a mean score of 3.03. Furthermore, the availability of personal computers was one of the aspects that could improve educators' preparedness to use ICT at home.

However, the findings from the study indicated that most of the respondents (department officials) cited poor connectivity to internet both at schools and at homes. Approximately (20%) of the respondents suggested that educators are not connected to the internet whilst (80%) of the respondents agreed that educators are connected to internet. Connectivity to internet plays a significant role in integrating ICT in teaching, hence, it is a necessity to always improve educators' connectivity to the internet.

Furthermore, ICT facilities mostly need power, and this prompted the researcher to find out the sources of power in Gauteng's public schools. The findings from the study indicated that most (80%) of the respondents cited electricity was provided by Eskom whilst a few (20%) mentioned use of solar panels. These results implied that most of the public schools rely on electricity and only a few on solar panels.

Moreover, the researcher found it necessary to check the reliability of electricity in the public schools since most of the respondents indicated that they use electricity. A great number of respondents (60%) cited unreliability of electricity in public schools whilst a few (40%) suggested that there is reliability of electricity in public schools. Therefore, electricity is not reliable most of the time because of load shedding, hence the need to put alternatives, for instance, generators and solar system. Vandalism will also require strengthening of security measures, especially for ICT enabled schools.

The respondents alluded to an urgent need to keep ICT facilities safe to prevent theft and destruction of ICT equipment. The researcher sought to establish if there are any security measures in place at public schools to prevent vandalism and theft of ICT facilities. The findings from the study indicated that a majority (60%) of the respondents agreed that security measures are in place to prevent vandalism and theft of ICT facilities whilst a few (40%) of the respondents disagreed that security measures are in place to prevent vandalism and theft of ICT facilities. It emerged that learners and educators take devices home as a security measure. Therefore, there is a need for the department to increase security measures so that ICT facilities are not vandalised to minimise disruption of classes.

The integration of ICT in teaching requires enough resources to kick start the e-learning programme in Gauteng public schools. It was very crucial for the researcher to find out whether the department has enough resources to roll out the e-learning programme. The findings from the study indicated that 80% of the respondents cited sufficient resources to roll out the e-learning programme whilst (20%) suggested that the department does not have sufficient resources to roll out the e-learning programme in Gauteng public schools. This implies that, whilst there is a majority view that ICT resources have been provided by government,there is still a room for improvement to ensure that more resources such as hardware, consumables and ICT support-related infrastructure are available for the programme to be a success.

Moreso, the researcher found it indispensable to check recommendations made by department officials regarding the roll out of the e-learning programme in Gauteng public schools. The findings indicated that most (80%) of the respondents cited training of educators and principals as well as providing enough ICT facilities so that they gain knowledge and skills which in turn facilitate smooth integration of ICT in teaching. The findings also indicated that respondents (20%) cited departmental support as a key factor to ensure that ICT is integrated well in teaching. These findings are in line with those of Ertmer and Ottenbreit-Leftwich (2010) and Prestridge (2016), which concluded that there is need for full encouragement from the department of education administration with regards to technical support, training, school culture; skills and knowledge required to successfully embrace ICT into pedagogical practice in the conventional core curriculum (Hew & Brush, 2006; Kirkscey, 2020; Kreijins, Acker, Vermeulen & Van Buuren, 2013).

Discussion

As indicated above, there were five themes and nine sub-themes that emerged from this investigation. This sections provides a descriptive narration of these themes in line with the fundamental objectives of this research.

Theme One: "Perceptions around the meaning of ICT and its purpose".

The findings were that majority of educators felt that ICT improves communication between learners and educators since it does not require physical contact and saves time. All respondents agreed that ICT is reliable for storing information and sharing that infor-

mation on a large scale. This theme is supported in literature by scholars such (Ghavifekr & Rosdy, 2015).In the context of developing nations like South Africa, access to ICT resources in education has been a challenge. It is not a simple task to adopt ICT-enabled pedagogical modalities with the goal of improving educational institution outcomes with little additional resources. In order to become extensively used and successful in the educational system, this technology must overcome a number of obstacles. The advent of ICT has made it possible for a teacher in one place to effectively reach pupils in another (Hew & Tan, 2016;Teo, 2015).

Once confined to a single classroom, today's educators are free to teach wherever they like. Educators are alerted and uneasy with this technological initiative since their material may be seen, monitored, and graded by anybody. Teachers worry that if their lessons don't live up to their students' high standards, they will be singled out and given negative publicity, which may have a devastating effect on their professional reputation and mental health (Drossel, et al., 2017; Lau & Yuen, 2013).

Effective facilitation and training are crucial for integrating ICT into the classroom. The material that is shared across nodes on the internet requires teachers to be intrinsically motivated to create it. Education that can be taken anywhere, or education on wheels, has been made possible because to ICT. The general population's competence with this technology, however, is poor. Educators' and learners' ICT use may be quantified thanks to many studies and data from continuing research on the technology acceptance model (T.A.M.) (Islam, 2016; Huang, 2017; Tate, et al., 2015).

Theme Two: "Perceptions around the benefits of ICT in education".

Both educators and learners are of the view that ICT assists in getting learning material on time because it is just a matter of uploading and downloading this material. It also encourages learners to get involved in learning activities, because of their interests in using gadgets. Literature indicates that the rapid growth of network-enabled services is directly correlated to the explosion in internet use among individuals of all ages all over the world. Almost all businesses, whether public or private, now support using networked, Internet-enabled services accessible remotely through the World Wide Web (WWW) in order to boost their profile on a worldwide scale (Saif, et al., 2022). The widespread use of distance learning in higher education has paved the way for more flexible, convenient, and open approaches to teaching and learning. Due to the convenience and flexibility of online learning, more and more people are pursuing academic goals (certifications, degrees, etc.) in this manner. Because of this flexibility, the scope of education is now global, transcending the borders that formerly divided countries. Students frequently drop out of school because they are met with political intolerance, racial discrimination, etc. when pursuing their education in a traditional classroom setting. However, the number of students who stop attending school due to the prevalence of online education has dropped dramatically (Ndibalema, 2014).

Theme Three: "perceptions around the shortfalls of ICT in schools".

Lack of training on educators since not all of them have ICT background. There's a need to provide continuous support on educators since this will encourage them to utilise ICT equipment. It became clear that most educators lack confidence in using ICT and fear that learners are more competent than them when it comes to ICT utilisation. Few teachers have successfully implemented the use of ICTs in the classroom, and gained confidence in using varied digital tools, as reflected in a few studies(Nkula & Krauss, 2014; Padayachee, 2016). Word processors, data projectors, PowerPoint,spreadsheets, search engines, interactive whiteboards, mobile technologies, smart phones (emails, blogs, videos, etc.), tablets, instant messaging, podcasts, CD-ROMs, Wikipedia, simulations, animations, and e-books are just some of the digital tools that have been mentioned in relation to ICT integration in the classroom(Mooketsi & Chigona, 2014; Costa, 2021; Mereku & Mereku, 2015; Assan & Thomas, 2012). While these studies provide evidence of ICT usage in the classroom, additional research is needed to determine which types of technology are being used and how this impacts pedagogy and subject knowledge.

Researchers have shown that educators' lack of confidence and misunderstandings about ICTs are to blame for their lack of implementation (Costa & Ntsobi, 2022). There is a misperception that merely introducing technology in schools would tackle educational access difficulties and educational challenges both learners and educators might face (Tamim, et al., 2015). Some of the precipitators of challenges faced by educators and learners in ICT adoption are attributable to (1) lack of time (Assan & Thomas, 2012); (2) lack of

clarity on the e-Education policy (Vandeyar, 2015); (3) lack of support, both in terms of infrastructure and policy (Vandeyar, 2015); and (4) a lack of skills in using ITC related tools (Msila, 2015). Yet, one of the main problems is that attention is paid more to the technical than the pedagogical and theoretical frameworks.

Theme four: "Perceptions around government's decision to introduce ICT in schools".

There's a firm belief that government introduced ICT in schools to promote efficiency and ensure learning is occurring in a conducive environment. This is also done in order to keep up with technological trends. All respondents felt that this is a requirement nowadays to use ICT otherwise you will be left behind. All of them were in support of government initiatives.

Theme five is about "perceptions on ICT and educators' daily duties". As indicated in theme one, most respondents are of the view that ICT improves communication between learners and educators. Majority of educators felt that ICT is assisting them to organise their administrative work. ICT assists them to prepare for lessons and at the same time achieving curriculum improvements.

Summary on responses from the Senior Managers of the Department of Education

The following is a brief summary of responses from the Senior Managers of the department in response to interview questions.

Interview question one

What are the factors that influence successful integration of technology to improve teaching and learning within Gauteng public schools?

The majority of the Senior Managers agree that training and development of educators and learners is important. The revamp of classrooms and schools is a precondition for the successful implementation of e-leaning in schools. Access to devices, connectivity and training of end users came out strongly from most Managers. Clear policy directives and implementation strategy that is easy to understand, management support and involvement of the political leadership in leading the process throughout.

Interview question two

What are key success factors that should be considered when implementing this project? And what has been achieved so far?

Allocation of dedicated resources for implementation of this project was one of the key success factors that was identified. Consultation with different key stakeholders in implementing the ICT strategy was also mentioned as a success. The development of the e-Book Catalogue made it easy for schools to exercise available options. Teachers are integrating ICT in their lessons. However, they are at different levels of e-Maturity. GDE is continuing to implement support strategies including training teachers on various ways to integrate ICT in the classroom (TPACK Focused).

Interview question three

Which lessons have been learned during implementation of ICT programmes in schools?

Senior Managers feel that teachers' and learners' attitudes play an important role in implementing a project of this magnitude. As stated above, focused training needs to be at the core of the implementation. Stakeholder buy in is key to ensure that the implementation is supported. The team handling the infrastructure and devices requires the curriculum team to translate the enablers into actual teaching and learning practice. Introduce the initiative in less stressful and pressurised classrooms, the lower the Grade the better (middle Grade preferably). Training and development were also raised as one of the lessons learned. Multi-stakeholder project team across all disciplines and functions was recommended Some lessons learnt from ICT implementation in Gauteng include the following:

- Incremental rollout works better than the whole school change - allows for adoption and institutionalisation.
- Good schools adopt ICT integration faster.

- Weak managers don't lead and teachers don't change teaching style.
- No adoption of smart content by teachers - Smart boards are just a replacement for chalkboards which defeats the integration purpose.
- Need for policy alignment across elements of the rollout process.

Interview question four

Which policy recommendations can be tabled to the Gauteng Provincial Education Department to ensure successful integration of ICT in public schools?

The responses suggested that schools management and administrative processes should be realigned in a number of ways. First, the school must take ownership and develop the capabilities to manage e-learning projects with minimal support from district and head office. Second, the asset management policies of the schools should be adapted to take ownership of the new assets.

School timetabling to ensure certain subjects are delivered only through ICTs in the classroom. Making it mandatory that educators attend integration of ICTs into teaching and learning annually to as part of the refresher training. Target the Senior Phase first, and gradually allow the introduction of the Further Education (FET) phase into the project.

Interview question five

What is your vision beyond 2025 with regards to the utilisation of ICT in Gauteng public schools? Is there any strategy in place to achieve this?

That all schools should be using ICT for teaching and learning by 2025. That all educators entering the school system should come with an ICT competency qualification. All learners should be provided with minimum ICT resources in schools. Remote/Virtual learning is supported to minimise the demand for physical classrooms. A whole suite of interventions will be required at home and in the school.

In all five questions, training and development came out strongly as recommendations that were made by the Senior Managers of the department. Stakeholder mobilisation and buy-in was also raised as one of the considerations that needed to be explored. The issue of access, connectivity, availability and proper utilisation of ICT resources also came out as a recommendation to be considered for successful implementation of this project.

Conclusion

The purpose of this study was to establish the preparedness and readiness of educators to integrateICT as an enhancement to teaching and learning. The study findings show that male educators have a higher and positive attitude towards ICT integration and utilisation in the classroom than their female counterparts. The study findings noted that most of the professional development support from the department provided to educators mainly empowers them on how best they can utilise information communication technology available, not how to effectively integrate the technology into the curriculum. Therefore, the participant educators, especially old ones, used the technology they were most familiar with and only young educators were willing to explore new technologies.

The results of this study confirm that even though resources and training were provided, educators are not sufficiently equipped to develop their own approaches that embrace ICT into the learning process. In most cases, educators are not using computers to prepare their lessons. A clear understanding of how educators integrate ICT in teaching is significant to develop and deliver effective educational opportunities to properly prepare learners for higher learning, work, and life in the 21st century.

References

1. Adams W. Conducting Semi-Structured Interviews. 4th ed. George, Washington: Jossey-Bass (2015).
2. Ahmad A and Starkey A. "Application of feature selection methods for automated clustering analysis: a review on synthetic datasets". Neural Computing and Applications 29.7 (2018): 317-328.
3. Albion P. "Looking for evidence of change: Evaluation in the Teaching Teachers for the Future project". Waynesville, Society for Information Technology & Teacher Education International Conference (2012): 1626-1633.
4. Albirini A. "Modern Arabic Sociolinguistics". 1st ed. Abingdon: Routledge (2016).
5. Assan T and Thomas R. "Information and communication technology integration into teaching and learning: Opportunities and challenges for commerce educators in South Africa". International Journal of Education and Development using Information and Communication Technology 8.2 (2012): 4.
6. Bandura A. "The power of observational learning through social modeling". In: R. Sternberg, S. Fiske & D. Foss, eds. Scientists making a difference. New York: Cambridge University Press (2016): 953.
7. Bordbar S and Mohammad S. "Differential Item Functioning Analysis of High-Stakes Test in Terms of Gender: A Rasch Model Approach". Malaysian Online Journal of Educational Sciences 5.1 (2017): 10-24.
8. Brinkerhoff J. "Institutional reform and diaspora entrepreneurs: the in-between advantage". 1st ed. New York, NY: Oxford University Press (2016).
9. Celik K and Yeşilyurt E. "Attitudes to technology, perceived computer self-efficacy and computer anxiety as predictors of computer supported education". Computer & Education 60.1 (2013): 148-158.
10. Costa K. "Data Driven Decision-Making (DDDM) for Business Leaders post COVID-19 Outbreak: A COSTA-webQDA Technique Proposition at 5th World Conference on Qualitative Research-20/01/2021". s.l., World Conference on Qualitative Research (2021).
11. Costa K and Ntsobi M. "The Role and Potential of Information Communication Technology (ICT) in Early Childhood Education in South Africa: A Theoretical Perspective". In: Cham, ed. Computer Supported Qualitative Research. Cham: Springer (2022): 353-367.
12. Drossel K, Eickelmann B and Gerick J. "Predictors of teachers' use of ICT in school-The relevance of school characteristics, teachers attitudes and teacher collaboration". Education and Information Technology 22 (2017): 551-573.
13. Dunn KE and Rakes GC. "Producing caring qualified teachers: An exploration of the influence of pre-service teacher concerns on learner-centeredness". Teaching and Teacher Education 26.6 (2010): 516-521.
14. Ertmer PA and Ottenbreit-Leftwich A. "Teacher technology change: How knowledge, confidence, beliefs, and culture intersect". Journal of Research on Technology in Education 42 (2010): 255-284.
15. Ertmer P and Koehler A. "Facilitated versus non-facilitated online case discussions: comparing differences in problem space coverage". Journal of Computing in Higher Education 27 (2015): 69-93.
16. Ghavifekr S and Rosdy W. "Teaching and learning with technology: Effectiveness of ICT integration in schools". International Journal of Research in Education and Science (IJRES) 1.2 (2015): 175-191.
17. Ghavifekr S and Rosdy W. "Teaching and learning with technology: Effectiveness of ICT integration in schools". International Journal of Research in Education. International Journal of Research in Education and Science (IJRES) 1.2 (2015): 175-191.
18. Guest G. "Describing mixed methods research: An alternative to typologies". Journal of Mixed Methods Research 7 (2013): 141-151.
19. Heale R and Twycross A. "What is a case study?". Evidence Based Nursing (2018): 7- 8.
20. Hew K and Brush T. "Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research". Educational Technology Research and Development 55.3 (2006): 223-252.
21. Hew K and Tan C. "Predictors of information technology integration in secondary schools: Evidence from a large scale study of more than 30,000 students". PLoS ONE 1 (2016).

22. Huang Y. "Exploring students' acceptance of team messaging services: The roles of social presence and motivation". British Journal of Education and Technology 48 (2017): 1047-1061.
23. Hughes C. "Japan's foreign and security policy under the 'Abe Doctrine': New dynamism or new dead end?". 1st ed. United Kingdom: Springer (2015).
24. Inan F and Lowther D. "Factors affecting technology integration in K-12 classrooms: A path model". Educational Technology Research and Development 58.2 (2010): 137-154.
25. Islam A. "Development and validation of the technology adoption and gratification (TAG) model in higher education". Journal of Technology and Human Interactions 12 (2016): 78-105.
26. Jamieson-Proctor R., et al. "ICT integration and teachers' confidence in using ICT for teaching and learning in Queensland state schools". Australasian Journal of Educational Technology 22.4 (2006): 511-53.
27. Jansen A. "The Understanding of ICTs in Public Sector and Its Impact on Governance". s.l., International Conference on Electronic Government (2012).
28. Johnson RB and Christensen L. "Educational research: Quantitative, qualitative, and mixed approaches". 6th ed. Los Angeles: Sage (2017).
29. Kalemoglu-Varol Y. "Investigation of Adolescents' Physical Education Trait Anxiety Levels by a Range of Variables". American Journal of Sports Science 3.1 (2015).
30. Karaseva A, Siibak A and Pruulmann-Vengerfeldt P. "Relationships between teachers` pedagogical beliefs, subject cultures, and mediation practices of students' use of digital technology". Cyberpsychology: Journal of Psychosocial Research on Cyberspace 9.1 (2015).
31. Kay A. "Separating sovereignty and sharing problems: Australian federalism and the European Union". Australian Journal of Public Administration 74.4 (2015): 406-418.
32. Kay K. "Rural rentierism and the financial enclosure of Maine's open lands tradition". Routledge 107.6 (2017): 1407-1423.
33. Khan S and Markauskaite L. "Technical and Vocational Teachers' Conceptions of ICT in the Workplace: bridging the gap between teaching and professional practice". Journal of Educational Computing Research 56.3 (2017): 1099-1128.
34. Kirkscey R. "mHealth apps for older adults: a method for development and user experience design evaluation". Journal of Technical Writing and Communication 51.2 (2020).
35. Knezek G and Christensen R. "Extending the will, skill, tool model of technology integration: adding pedagogy as a new model construct". Journal of Computing in Higher Education 28 (2016): 307-325.
36. Kopcha T. "A systems-based approach to technology integration using mentoring and communities of practice". Educational Technology Research and Development 58.2 (2010): 175-190.
37. Kreijns K., et al. "What stimulates teachers to integrate ICT in their pedagogical practices? The use of digital learning materials in education". Computers in Human Behavior 29.1 (2013): 217-225.
38. Lau W and Yuen A. "Educational technology training workshops for mathematics teachers: An exploration of perception changes". Australas Journal of Educational Technology 29 (2013): 595-611.
39. Likert R. "A Technique for the Measurement of Attitudes". New York: New York: Archives of Psychology (1932).
40. Lowther D., et al. "PD-1 marks dysfunctional regulatory T cells in malignant gliomas". JCI Insight 1.5 (2016): e85935.
41. Luterbach KJ and Brown C. "Education for the 21-st century". International Journal of Applied Educational Studies 10.2 (2011): 14-32.
42. Markauskaite L. "Gender issues in preservice teachers' training: ICT literacy and online learning". Australasian Journal of Educational Technology 22.1 (2006): 1-20.
43. Mburugu K, Mulwa A and Kyalo D. "Organizational Culture and Implementation of Electronic Project Monitoring Information System in Public Tertiary Institutions in Kenya". International Academic Journal of Information Systems and Technology 2.1 (2017): 61-77.
44. Mereku DK and Mereku CWK. "Congruence between the intended, implemented, and attained ICT curricula in sub-Saharan Africa". Canadian Journal of Science, Mathematics and Technology Education 15.1 (2015): 1-14.

45. Mooketsi B and Chigona W. "Different shades of success: Educator perception of government strategy on e-Education in South Africa". The Electronic Journal of Information Systems in Developing Countries 64 (2014): 1-15.
46. Msila V. "Teacher readiness and Information and Communications Technology (ICT) use in classrooms: A South African case study". Creative Education 6.18 (2015).
47. Ndibalema P. "Teachers attitudes towards the use of information communication technology (ICT) as a pedagogical tool in secondary schools in Tanzania: The case of Kondoa district". International Journal of Educational Research 2 (2014): 1-16.
48. Nkula K and Krauss KE. "The integration of ICTs in marginalized schools in South Africa: Considerations for understanding the perceptions of in-service teachers and the role of training". International Development Informatics Association (IDIA) (2014): 3-5.
49. Ntsobi MP. "Pedagogical integration of technology as an enhancement to teaching and learning in Gauteng public schools". Johannesburg: Da Vinci Institute for Technology Management (2021).
50. Padayachee K. "A stepwise framework toward ICT integration in Education: A South African perspective". Durban, 3rd IEEE International Conference on Advances in Computing, Communication and Engineering (2016).
51. Park M and Sung Y. "Teachers' perceptions of the recent curriculum reforms and their implementation: What can we learn from the case of Korean elementary teachers?". Asia Pacific Journal of Education 33.2 (2013).
52. Peralta H and Costa F. "Teacher's Competence and Confidence regarding the use of ICT". Educational sciences journal 3 (2007): 75-84.
53. Ponto J. "Understanding and Evaluating Survey Research". Journal o Advanced Practical Oncology 6.2 (2015): 168-171.
54. Prestridge S. "Conceptualising self generating online teacher professional development". Australia: Technology Pedagogy and Education (2016).
55. Punch S. "Why have generational orderings been marginalised in the social sciences including childhood studies?". Children's Geographies 18.2 (2019): 128-140
56. Reno M., et al. "Influence of inverter-based resources on microgrid protection: Part 1: Microgrids in radial distribution systems". IEEE Power and Energy Magazine 19.3 (2021): 36-46.
57. Saif S., et al. "Impact of ICT in Modernizing the Global Education Industry to Yield Better Academic Outreach". Sustainability 14.11 (2022): 1-18.
58. Schoonenboom J and Johnson R. "How to Construct a Mixed Methods Research Design". Köln Z Soziol 69 (2017): 107-131.
59. Shapka JD and Ferrari M. "Computer-related attitudes and actions of teacher candidates". Computers in Human Behaviour 19.3 (2003): 319-334.
60. Simin G., et al. "Teaching and Learning with ICT Tools: Issues and Challenges from Teachers' Perceptions". Journal of Educational Technology 4.2 (2016): 38-57.
61. Tamim R., et al. "Tablets for teaching and learning: A systematic review and meta-analysis". Commonwealth of Learning (2015): 1-56.
62. Tate M, Evermann J and Gable G. "An integrated framework for theories of individual attitudes toward technology". Information Management 52 (2015): 710-727.
63. Teo T. "Comparing pre-service and in-service teachers' acceptance of technology: Assessment of measurement invariance and latent mean differences". Computer Education (2015): 22-31.
64. Tondeur J., et al. "Getting inside the black box of technology integration in education: Teachers' stimulated recall of classroom observations". Australasian Journal of Educational Technology 29.3 (2013).
65. Tsai M., et al. "The effectiveness of a flood protection computer game for disaster education". Visualization in Engineering 3.1 (2015): 1-13.
66. Van den Berg G. "Learning theories and the use of technology in the classroom". In: E. Swart & J. Eloff, eds. Understanding Educational Psychology. Cape Town: Juta (2017): 69-76.
67. Veenhof B, Clermont Y and Sciadas G. "Literacy and Digital Technologies: Linkages and Outcomes". Canada: Research Paper for Science (2005).

68. Volman M and Eck E. "Gender equity and information technology in education: The second decade". Review of Educational Research 71.4 (2001): 613-634.
69. Yukselturk E and Bulut S. "Gender Differences in Self-Regulated Online Learning Environment". Educational Technology & Society 12 (2009): 12-22.

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