The role and potential of Information Communication Technology (ICT) in early childhood education in South Africa: A theoretical perspective

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Abstract

This paper discusses the role of ICT in early childhood education in South Africa. It gives a reflection of the best practice alongside the current local status of ICT in Education. The study adopted a qualitative research method leaning more towards the interpretivist research paradigm. Desktop literature review was conducted in order to have a feel of the nature of ICT, looking at the Global, Continental (Africa) and local context. The research encompasses literature on both children and educator's use of ICT in early childhood education and elaborates on the role of ICT with regards to teaching and learning and professional development. Key findings were that, through the adoption and proper usage of ICT, great value is added to the learning and teaching process. The study found that instead of being passive assimilators of information, learners become more engaged not only in recollection and understanding but also in application, evaluation and creation during the learning process.

In order to optimise the impact of ICT in early childhood education in South Africa, the research recommended: the deployment of more ICT infrastructural resources in public primary schools, the need to train all role players on the usage of ICT, prioritisation of ICT in strategy formulation and budget allocations, introduction of learners to basic ICT skills in the lower classes, comprehensive repair and maintenance of the ICT equipment for optimal functioning, shifting focus from learner performance to capacity development, a phased approach comprised of appropriate interim targets, needs analysis have to be conducted and the measurement of progress to assess if objectives are met and taking corrective measures where deviations are experienced.

Key words: Early childhood development, Educational outcomes, Education transformation, Gauteng Department of Education, Information Communication Technology, Pedagogical value

1. Introduction

The introduction and adoption of information and communications technology (ICT) in the South African education system is gaining momentum especially in Gauteng, the Western Cape and Free State provinces. Various stakeholders that have undertaken these initiatives include but not limited to non-governmental organisations (NGOs), research institutions, and Departments of Education both at provincial and national levels. A national vision for the introduction of ICT in education was launched in 2015 by the Operation Phakisa initiative, defining the six pillars around which this vision would be implemented (Amory, 2015). A combination of this bottom-up and top-down approach and the integration of many other stakeholders have to date led to different dimensions in terms of the performance of the role of ICTs in education. The objective of the study was to explore the significance of introducing ICT in early childhood development.

During 2020, the world experienced a global pandemic – COVID-19. This brought into sharp focus the importance of ICT in education. This is also signaled that ICT in education is not an add-on but must be integrated into day-to-day schooling programme. The GDE's programme that started in 2014 was proof of the indispensable nature of ICT in the classroom. At the same time however, the gaps that emerged during this period presented an opportunity for enhancing ICT in schools. The introduction and integration of technology to enhance teaching and learning has become inevitable, therefore there is need to explore the benefits and potential role of ICT adoption at early childhood development within the South African context.

1.1 Status of ICT in ECD

Research carried out to date does suggest the three reasons why ICT is crucial in early childhood education:

1.1.1 The environment that surrounds young children's learning has been immensely affected by ICT.

Firstly, the physical and social worlds that children find themselves in have all been subjected to ICT. All the role players such as educators, parents, caregivers and family members have had ICT as their integral part of their private and work lives. Thus, literature has argued that children's early childhood education experiences should integrate and interconnect with the experiences in the outside world. It is therefore imperative that ICT plays an important role in integrating children into the outside world with which they will have to interact.

1.1.2 ICT offers new opportunities to strengthen many aspects of early childhood education practice

ICT offers great opportunities to the education sector in the form of enhancing children's learning and playing experiences, supporting and strengthening practitioners' professional learning and development, networking and interaction between early childhood centers, parents, and other role players connected to the early childhood education setting. Much of the literature on ICT in early childhood education points to the fact that on its own, technology must not spearhead the aspect of ICT development in the sector (Downes & Fatouros, 1995). Instead, the whole process of application of ICT by role players such as children and adults should be anchored on clear understanding of the objectives, practices, and social context of early childhood education (O'Hara, 2004; O'Rourke & Harrison, 2004; Sheridan & Pramling Samuelsson, 2003). Brooker (2003) has asserted that United Kingdom (UK) stands out in terms of ensuring that children get the best experience through the development of best practice in the application of ICT.

1.1.3 There has been a growing global interest and support across the entire education fraternity regarding the adoption, integration and utilisation of ICT in curriculum delivery

The entire education sector has experienced a paradigm shift regarding the adoption of the ICT policy in the teaching and learning process. The whole spectrum of the education sector which constitutes primary, secondary, and tertiary education has been compelled to seriously consider the application and integration of this policy in their curricula. Nevertheless, the adoption of this policy of developing ICT in the early childhood by most countries has been very slow, (O'Hara, 2004; Sheridan & Pramling Samuelsson, 2003; Stephen & Plowman, 2003) though some countries, like Scotland, have recently developed ICT strategies for the early childhood education sector (Learning and Teaching Scotland, 2003b).

There is existing research and publications providing insights to ECD practitioners and Education Stakeholders on the benefits of ICT in early childhood (Downes, Arthur, & Beecher, 2001; NAEYC, 1996; O'Hara, 2004; Siraj-Blatchford & Siraj-Blatchford, 2003). To this end, there is need therefore to explore the benefits and potential role of ICT adoption at early childhood development within the South African context.

1.2 Objectives of the study

- To ascertain the benefits of integrating Technology in early childhood education in South Africa;
- To identify the challenges that have slowed down the effective integration of ICT in early childhood education in South Africa;
- To identify factors influencing the successful integration of technology in early childhood education in South Africa; and
- To provide recommendations on how ICT can be successfully integrated by the South African Schools to improve teaching and learning at early childhood phase.

1.3 Significance of the study

- *Learners* - If properly applied, ICT has proved that learners can benefit in terms of language development, the development of mathematical thinking as well as supporting learning for children with special learning needs. ICT gives children a platform to blend together words, pictures, and sounds, thus giving them the opportunity to convey their ideas, thoughts, and feelings.
- *Educators* – The research will also help educators among other role players, to understand the importance of ICT at early childhood development and what they need to do in order to be effective in its usage.
- *Department of Basic Education (DBE)* – The research recommendations will help the department to understand what strategies need to be employed in order to effectively integrate the policy.

2. Methods

The study was carried out using a mixed methods approach. Mixed methods research is a tradition of inquiry that is inherently located in pragmatism, as depicted in the research onion (Saunders, Lewis & Thornhill,2019) as depicted in Figure 1 below.

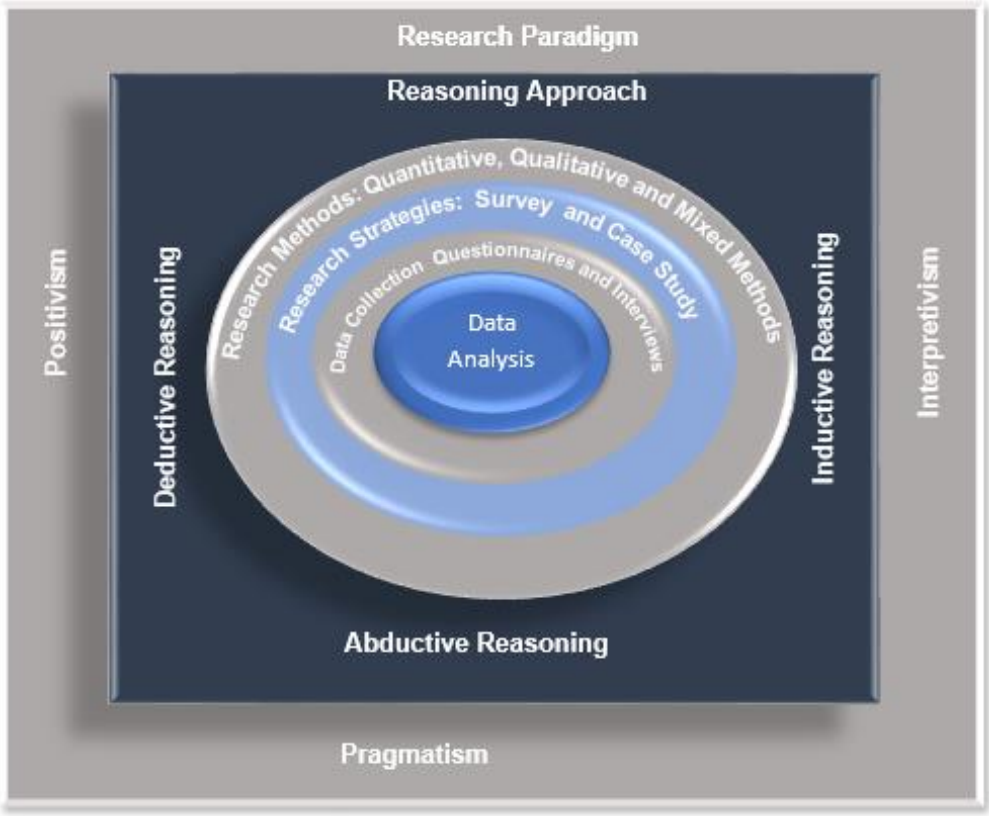

Figure 1: Research Design and Approach

2.1 Research Design

To collect data, a mixed method approach was employed using qualitative primary data and both quantitative and qualitative secondary data collection methods. This approach was adopted as it gives a deeper study of the preparedness of educators in using ICT in public secondary schools. Creswell (2014) states that the gathering of numeric data from the population is enabled through descriptive survey on attitudes, behaviour, trends and opinions.

Costa (2020) provided a typology of mixed methods approaches suitable for a study of this nature. As has been explained, this method is a kind of research approach that combines both quantitative and qualitative measures, solely designed to strengthen research integrity, credibility and believability, as Schoonenboom and Johnson (2017) propounded. Researchers have to decide regarding the typology of their study, regarding which design within the mixed approach would be core and which one would be supplemental.

Costa and Tumagole (2020) highlighted that there were five types of techniques under this framework, based on work by Creswell and PlanoClark (2011);Greene and Caracelli (1997). These forms might be:

(i) *QUAL* + quan indicates the core part of the qualitative dimension and the quantitative complementary component. It also refers to a reasonable method following a parallel inductive research technique. This means that quantitative and qualitative components are simultaneously available.

(ii) *QUAL-quan*. The qualitative aspect is regarded as the core element of this typology. Furthermore, it refers to a logical method that takes an inductive sequential investigation strategy. This means first the qualitative aspect and then the quantitative element.

(iii) *QUAN* + *qual*. This notation indicates that the quantitative dimension is core and the qualitative is supplemental. The theoretical notation further indicates that the design will be simultaneous, meanings that data collection occurs at the same time within the different components of the mixed methods approach.

(iv) *QUAN-qual*: The quantitative dimension is described as the core feature and the extra qualitative approach to inquiry. This means that the quantitative part takes place first, followed by the qualitative component. Full typologies with theoretical notations are depicted in Figure 2.

Figure 2: Typology of Mixed Methods designs - Source: Costa and Tumagole (2020)

The non-numeric data gathered through the qualitative research design included the interview data of the level of preparedness of teachers towards the use of ICT in the classroom (Cresswell, 2014). This was analysed using a qualitative content analysis process and themes established of dominant and non-dominant perceptions. Data was collected in this study from online respondents in Johannesburg, Ekurhuleni and Tshwane regions' public schools to determine the preparedness of educators to use ICT as a teaching tool.

2.2 Population sample

The population sample in this study consisted of educators and subject advisers in the Johannesburg, Tshwane and Ekurhuleni region's public schools. This target population suited this study's main thrust in assessing educators in the public secondary schools on their preparedness to use ICT as a teaching tool. For the quantitative dimension of this study, the population sample was constituted of 525 ICT Educator Champions, 12 school principals, 15 subject advisors and 5 provincial officials, selected through simple random sampling approach (Babbie & Mouton, 2016). For the qualitative dimension, the sample was made up of purposively educators and subject advisers that formed from the targeted locale as mentioned above selected (Ames, Glenton & Lewin,2019).

3. Key findings

3.*1 ICT and its relevance in early childhood education*

Meyer & Gent (2016), define ICT as "any means that enables people to acquire information, to communicate with each other, or to affect the environment using electronic or digital gadgets". In the context of early childhood education (ECE), the term ICT does incorporate computer hardware and software, digital cameras and video cameras, the Internet, telecommunication tools, programmable toys, and a whole lot of devices and resources that are applied in order to facilitate and optimize the teaching and learning process.

3.2 ICT and young children

Bolstad (2004) points out that some authors have voiced the view that computer/ICT usage and application is detrimental to young children's cognitive, physical, social, and emotional development. Nevertheless, there has not been any concrete supportive evidence of these allegations. On the other hand, if ICT is applied in a proper manner, it can positively impact on learners' academic development. However, there is no clear evidence to support this claim, and

this view has increasingly been replaced by the view that, when used appropriately, ICT can be a useful tool for supporting young children's learning and development.

In the same vein, Bolstad (2004) stipulates that most authors noted the need for practitioners to take precautionary measures on health and safety issues as children engage in the application of ICT. Children's physical and ergonomic safety is of paramount importance as well as their exposure to inappropriate content such as internet-based violence or pornographic material, or undesirable gender or cultural stereotypes.

3.3 Using ICT to enhance the early childhood learning environment

ICT has the ability to create a learning environment that enhances young children's learning though this depends on the practitioners' ability to come up with the right tools and how they can use them to support children's learning, development and play. Meyer & Gent (2016) assert that case studies have shown that practitioners for early childhood education have applied ICT to support different practices they perceive to support children's learning directly or indirectly some of which include directly helping the use of ICT by children as well as the use of ICT to come up with a curriculum based on the children's interests, ideas, and experiences.

3.4 The Global Perspective

In China, Liu and Pange (2015) discovered that the adoption of ICT is hampered by lack of hardware (laptops, notebooks, and computers), teaching material, pedagogical models, teachers' interest as well as teachers' support. The Action Plan (eLAC, 2015) on the Information Society in Latin America and the Caribbean (ECLAC, 2010) points out that ICT is a gateway to social inclusion and economic development. Besides, eLAC2015 has prioritized the integration of ICT in education and, particularly, to provide universal access and inclusive education. Across Canada, from Newfoundland and Labrador to British Columbia educational authorities and teachers, there is a growing realization that 'digital literacies' are becoming essential in preparing students for full participation in the emerging post-industrial 'knowledge society' of the 21st century.

Research in countries comprising Australia (Cooper, Farquhar, & McLean, 2001; Downes, 2001), Finland (Kankaanranta & Kangalasso, 2003), the UK (O'Hara, 2004), Scotland (Learning and

Teaching Scotland, 2003a), and New Zealand (Bain, 2000) assert that ICT application is very low in many early childhood education settings, and that practitioners for early childhood education are not very sure about the importance of ICT in contributing towards their practice. A lot of differences do occur regarding interest in adopting ICT by various educators from different parts of the world. In other cases, survey results in many schools have shown that a good number of practitioners are either technophobic or incompetent technically. Nevertheless Dawes (1999) argues that the reason for educators seemingly reluctance in adopting the ICT should not be attributed to them being incompetent or technophobic but rather as a result of judgment about the relevance of ICT in educational settings (O'Hara, 2004). According to Dockett (1999), research carried on 58 New South Wales early childhood centers discovered that 31 percent of the centers was in possession of a computer but many educators affirmed that they never used computers with the children (Stephen and Plowman, 2003) describing the use of ICT in early childhood centers in Scotland as “a work in progress”.

3.5 ICT Financing in Schools as a Global Challenge

ICT funding for schools has always been a major challenge as budget is many cases constrained given other priorities like boarding, tuition and other infrastructure. McHugh (2019) points out that in Ireland, the government has set aside €50 Million for the funding of ICT in schools. Maxxia ICT journal (2019) states that today’s schools operate with tight budgets making it difficult for them to acquire new ICT equipment and are therefore left with two options either to lease or buy secondhand computer hardware resources. The increasing importance of ICT comes with it the need to procure quality and reliable equipment if schools are to effectively implement it and unfortunately this is met with strained budgets. As a result, most governments have resorted to financing the project. In the UK for example, according to Education Business Report (2019), its Chief Executive Officer (CEO), Valerie Thompson pointed out that financial constraints have caused schools to struggle both in the maintenance as well as procurement of new equipment. In Africa, United Nations Education Scientific and Cultural Organisation (UNESCO) in partnership with Korea is in the process of introducing the utilization of mobile phones in the teaching and learning process in countries such as Mozambique, Rwanda and Zimbabwe. This is a much cheaper way of applying the ICT tool given the fact that many people do have cell phones. The Kenyan government through Ministry of Education (MOE) has come through in the funding of ICT in schools. The Kenya Education Sector Support Program (KESSP) was established by MOE in 2005 giving emphasis on ICT as an important area to streamline ICTs into the classroom activities. Thus, the government in partnership with a number of Non-Governmental Organisations (NGOs)

has been playing a leading role to ensure that every constituency has a computer laboratory fully furnished with computers, internet, and printers (KESSP report, 2005).

4. Discussion

4.1 What is the role of technology in teaching and learning?

Below is a breakdown of some of the models that describe the role that technology is supposed to play in the process of learning (Meyer and Gent, 2016). The Blooms Taxonomy Model as well as three technology-focused models are more relevant for ICT in early childhood development:

Table 1: Blooms Taxonomy

	Focus	Elements or dimensions
Bloom's taxonomy	• Educational objectives classification. • Curricular activities structuring.	A transition from recalling facts to generating new and authentic work.
TPACK framework	Gives emphasis to knowledge elements necessary for teaching using technology.	Knowledge of Technological and pedagogical content and overlaps between these two.
NIMB framework1	Based on the integration of numerous models, it gives a description of the ways in which ICTs can be applied in teaching and learning.	The impact of learning ideas, ICT in education, and models of learning design on the transition of learning as described by Bloom's taxonomy.
UNESCO framework	Describes the different dimensions of ICT competencies necessary for a teacher to develop to be able to use technology in teaching.	Outlines the development by a teacher regarding technological literacy, create and deepen knowledge.

Source: Meyer and Gent (2016)

The most important and striking similarity that these models exhibit is that they all describe a transition or progression of teaching and learning. Table 2 below depicts a transition described by Bloom's taxonomy in light of ICT adaptation in schools or education sector.

Table 2: Bloom's Taxonomy Transition

Remember	Understand	Apply	Evaluate	Create

4.2 Implication of the models

Furthermore, Meyer & Gent (2016) point out that the illustration from the above-mentioned models denote that ICT plays a crucial role within the education sector through supporting a progression or transition of learning and is best applied in support and pursuit of a value a creation process in teaching and learning. A provision of electronic access to learning material for example by use of a tablet connected to a local server will be the same as giving a learner a textbook. Nevertheless, if the teacher element is removed, the one who helps the learners to remember and use facts in order to generate new knowledge, then the results yielded by such a technological intervention will be very limited. Thus, the role of technology in teaching and learning include:

- ***Supporting the operation of the education system***

  This role aims at enhancing an effective functioning of the education system and the application of the ICT in this regard incorporates:
  - Recording of management information including learner and teacher records as well as test results among others.
  - Computerised administration activities such as books of accounts, compilation of school timetables and the calculation and paying of teachers' remunerations.
  - Management information reporting at different levels of the system that is the school headmaster, the district, the provincial department and the national department.

4.2 Best practices and critical success factors – The South African Context.

The following available literature shows the best practices and critical success factors that need to be considered for the effective implementation of ICT (Amory, 2015 and Ostrowick, 2016):

4.2.1 Macro level

National and provincial - Provide leadership and facilitate integration

There is need for effective leadership that has a clear vision and objectives as well as accountability at both national and provincial level, a strategy for ICT integration in support of pedagogy and a strategy for integrated teacher development.

4.2.2 Micro level

School management, teachers and projects - Create an enabling environment, learn and apply, integrate with the context

Build an environment that is favorable (systems, practices, scope for training); facilitate appropriate professional training and development; learn from each other; develop and integrate context-specific, transferrable and affordable solutions; engage the community.

4.3.3 *All levels of the educational system - Ensure alignment*

Create cohesion from strategy to implementation. Properly align external stakeholders and guarantee integration with the system prior to projects or programs transfer. Be wary of various activities that need to happen at different levels. Make sure the right things are happening at the right places, in line with where the skills, scope and decision–making authority reside. The development of policies to guarantee consistency in standards should be put in place at national level, not provincial level.

4.4 Current South African strategy and policy

Table 3 below is a summary of the current policy environment in the form of policy documents, and outlines challenges expressed in recent dialogues (Amory 2015).

Table 3: Current policy environment

Policy environment	Concerns
Integration of ICT in all schools in South Africa, a full engagement of ICT in the curricula and an e-skilled educator workforce—to enhance quality education—defined collectively by the following documents:	• Policy dialogue on ICT in Education (2014) • Transformation in school management and provision of teaching and learning.

• National Education Policy Act (27/1996) The national policy framework for teacher education and development. • White paper 7 on e-education (1896/2004) Transforming Learning and Teaching through Information and Communication Technology • Action plan to 2019 Towards realisation of Schooling 2030. • National integrated ICT Policy green paper. • Strategy for Information Technology in Education (DBE, 2001). • GDE ICT/eLearning Strategy.	• Impact affected by slow and uncoordinated implementation. • GDE study on e-maturity and e-readiness (2010) Inconsistent connectivity, poor leadership by school administrators, inadequate ICT skills of educators, limited learner access to ICTs are the major inhibitors to e-readiness.
Phakisa has six focus areas for the integration of ICT in Education: management systems, curriculum content, TPD, ICT infrastructure, and connectivity	• Unclear, context-sensitive definition of objectives. • Lack of an integration strategy. • Clear prioritisation within the constraints of the budget. • One-size-fits-all approach, that does not recognise the diversity of South African schools.

Source: (Amory 2015)

4.4.1 Key challenges hindering swift adaptation of ICT in early childhood education in South Africa according to (Ostrowick, 2016):

- In-spite of the existence of policy, the implementation of the policy is very sluggish and the capacity is not sufficient. Ambiguous objectives and a lack of an integrated strategy across the system have affected progress as well.
- Limited and unequal access to technology across provinces and quintiles. Progress is also fragmented because of the absence of clear, integrative provincial strategies.
- Lack of prioritisation of a systematic change management has defeated the intended purpose of ICT.

5. Conclusion and Recommendations

5.1 Conclusion

To sum it all, this article integrates learning from three sources to outline the role of ICT in the South African education context and hinges on best practice and critical success factors, the current status of the ICT policy as well as the pathways to progress. The study has ascertained great strides that South has made in recent years though there is still room for much improvement and the recommendations below act as the roadmap to greater achievements.

5..2 Recommendations.

- More ICT infrastructural resources are needed in public primary schools as the current resources are insufficient.
- There is need to train all the students, teachers, non-teaching and school administrators on the usage of ICT to guarantee successful implementation.
- Prioritisation of ICT in strategy formulation and budget allocations.
- Introduction of students to basic ICT skills in the lower classes.
- A comprehensive repair and maintenance of the ICT equipment for optimal functioning.
- Shifting focus from learner performance to capacity development.
- A phased approach composed of appropriate interim targets needs to be taken.
- Measurement of progress to assess if objectives are met and taking corrective measures where deviations are experienced.

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