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RESEARCH ARTICLE

Analysis of Communication and Information Science Education Inclusivity in a STEM Environment in Zimbabwe

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ABSTRACT

Communication and Information Science (CIS) can be effectively applied in a STEM environment if ICT is accessible to people including those who are visually impaired (VI). This is premised on that Information and Communication Technology (ICT) has invaded every part of society, from home, industry and social life, as the world moves rapidly into digital media. One way of ensuring the effective inclusion of VI people in communication and Information Science is to have an education system from preschool, secondary through to tertiary which has inclusive ICT education. Apart from engendering CIS, ICT promotes/enhances student-centered learning consistent with STEM objectives. Through Zimbabwe's education system, the visually impaired (VI) people like anybody else, need to understand and apply ICT as a tool to aid their learning, professional development, and a means of socializing. What is questionable is whether the education system of Zimbabwe from preschool, prepares VI people to be effective users of ICT as STEM objectives suggest. In order to gain insight, curricula documents for a selected teachers' college T and Ministry of Primary and Secondary Education curriculum documents were analyzed. Also, data was generated through interviews and focus group discussion with VI pre-service teachers at teachers' college T. The interviews and focus group discussions aimed to generate data through VI pre-service teachers' reflections on their primary and secondary school days, juxtaposed with their current experience during teacher training with respect to inclusivity on use of ICT as a tool for teaching and learning, aiding personal learning and social life interactions. All the 10 VI pre-service teachers involved in the study concurred that if ICT learning and application begins as early as primary level, one is bound to develop high competence and confidence in ICT use. However, a very supportive environment, morally and materially, was seen as crucial in developing high competence and confidence levels of VI persons in using ICT for learning and in social life.

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1. INTRODUCTION

Information and Communication Technology (ICT) is a general term which refers to all kinds of technologies that enable users to access and manipulate information. ICT in this study will be taken to mean the computer, computer hardware and software and internet connections used to manage and communicate information for learning, business or social purpose (Mikre, 2011). Rapid development in Communication and Information Science (CIS) as Nguyen (2013) observes, is resulting in an ICT revolution, making ICT competency essential for citizens living in the 21st century. ICT is recognized as a catalyst for change in working conditions, handling and exchanging information, teaching and learning approaches and scientific research (Adiwa - Ogebaen and Iyamu 2005; Brun and Hinostroza 2014). Therefore, globally everybody should be ICT complaint (Kahveci, Şahn, and Genç, 2011).

Social platforms like Facebook, WhatsApp, and learning modes like open and distance e-learning (ODeL) are examples of significant applications of ICT. Like anybody else, visually impaired (VI) people need to understand and apply ICT as a tool to aid learning, in addition to communicating (Shane et al, 2012). ICT is an important component of education every learner should use, in pursuant of sustainable development goals (SDGs) (G3ict, 2016).

Global View on ICT

According to (Kumar, 2008) knowledge has become the most critical resource for both individual and national socio-economic development. Accessing and sharing information through the internet has made knowledge and ability to use computer and Internet effectively, prerequisites for human life quality. Thus as, Simset, Altum and Ates (2010) view it, access to computers and the World Wide Web are increasingly required for education and employment, as well as for many activities of daily life.

Importance of Integrating ICT in Education

Understanding the importance of information and communication technology (ICT) in Education is possible if there is an understanding of the roles of ICT. Meenakshi (2013) identifies ICT as diverse technological tools and resources used to create, manage, store and disseminate information. ICT enables today's teachers to make subject content accessible to learners by using multiple means of communication, including digital media (Mngo

and Mngo, 2018). Using ICT, teachers integrate cross-disciplinary skills (e.g.,critical thinking, problem-solving, creativity, communication) to help learners use knowledge to propose solutions, forge new understandings, solve problems, and imagine possibilities (Council of Chief State School Officers (CCSSO), 2011).

ICT integration implies extending the use of computers beyond specialist courses and special projects to the everyday practice of mainstream education classes (Ruthven, Hennessy, and Brindley, 2004). Student-centered learning environment which is ICT enhanced facilitates active, collaborative, creative, integrative, and evaluative learning which is an advantage over the traditional method. As such, ICT is influencing the way of learning at all levels.

VI People Right to ICT and Global ICT Inclusivity

Bojarski, Hofbauer and Mileszyk (2014) observe that the Charter of Fundamental Rights of the European Union (EU) which concurs with the United Nations (UN) Universal Declaration of Human Rights states education as a human right and that any discrimination based on any ground such as sex, race, color, ethnic or social origin or any reason should not be tolerated. Then students with disabilities have the right to expect the same standard of education as their schoolmates. In this context, VILs have the right to access and use mainstream educational tools, including ICT.

Rationale for Use of ICT by VILs in Education

The application of ICT in education enhances student-centered learning. Regardless of all the limitations characterizing ICT, it benefits education systems in providing quality education in alignment with constructivism, which is a contemporary paradigm of learning. One aspect of the power of technology is that it makes learners both more independent and collaborative (CCSSO, 2011). This is particularly important for VILs (Molster and Nes, 2018), who have been dependent for a long time on fellow non–VILs to learn.

Promotion of equality among learners is very important, therefore all students should have equal opportunity and appropriate support to acquire competence with ICT, irrespective of whether they have a physical disability or not (Shane et al, 2012). This prepares them for participation in the information society. For this reason, Lidstrom and Hemmingsson (2014) posit that ICT, particularly computers and the Internet, have been incorporated into teaching and learning.

Of great importance to VI people is assistive technology (AT) like voice prompts on cell phones and computers, which help VI people to make calls and read independently. AT is any adaptive device or service that increases participation, achievement or independence of a person with a disability (Schwab Foundation for Learning, 2000; Solomon and Bhanda, 2015). However, to maintain equality and fairness among learners, AT should not give an unfair advantage to VILs over non–VILs (Abed, 2018). Consequently, from an equality perspective, all students should have equal opportunity and appropriate support to acquire competence with ICT, irrespective of whether they have a physical disability or not (Shane et al, 2012). This avoids discrimination (Bojarski, Hofbauer and Mileszyk, 2014).

Effective Application of CIS

Based on the literature review above, Communication and Information Science (CIS) can be effectively applied in a STEM environment if ICT is accessible to people including those who are visually impaired (VI). This is premised on that ICT has invaded every part of society, from home, industry and social life, as the world moves rapidly into digital media (Kahveci, Şahn, and Genç, 2011). One way of ensuring the effective inclusion of VI people in Communication and Information Science is to have an education system from preschool, secondary through to tertiary, which has inclusive ICT education. Apart from engendering CIS, ICT promotes/enhances student-centered learning consistent with STEM objectives.

Purpose of the Study

Through Zimbabwe's education system, the visually impaired (VI) people like anybody else, need to understand and apply ICT as tool to aid their learning, professional development, and as means of socialising. What is questionable is whether the education system of Zimbabwe from pre-school to tertiary level, prepares VI people to be effective users of ICT as STEM objectives suggest. The purpose of study is to gain insight on inclusivity of Communication and Information Science Education in a STEM Environment in Zimbabwe, with reference to visually impaired learners (VILs) in ICT use for learning.

Research Questions

The research questions which guided the study are:

1. How do VI pre-service teacher at teachers' college T understand Communication and Information Science Education Inclusivity in a STEM Environment in Zimbabwe ?.
2. What could be done to enhance Communication and Information Science Education Inclusivity for the education system of Zimbabwe in a STEM Environment ?.

2. RESEARCH METHODS

Mainstreaming pre-service teacher training and being easily accessible to the researcher are the reasons why out of 15 teachers' colleges in Zimbabwe, college T was purposively and conveniently selected.

Document analysis was done first, and data gathered was analysed to subsequently focus interviews on generation of data answering research questions. Curricula documents that were analysed are teachers' college T and Ministry of Primary and Secondary Education (MoPSE). Analysis of documents focussed on finding out specific reference and emphasis for inclusion of VILs (pre-service teachers at college level and pupils at school level) in ICT use. The term ICT was analysed to find out whether it was used with clear reference to VILs. Also, data were generated through interviews of VI pre-service teachers at teachers' college T. The interviews aimed to generate data through VI pre-service teachers' reflections on their primary and secondary school days, juxtaposed with their current experience during teacher training with respect to inclusivity on use of ICT as a tool for teaching and learning, aiding personal learning and social life interactions.

The last data generating method used was focus group discussion (FDG). This is a way of collecting qualitative data involving a small number of people in an informal group discussion focused around a particular topic or a set of issues (Harrell & Bradlley, 2009). FGD was done last with all the 10 VI pre-service teachers, when interviews were no longer adding new information to the data gathered. ie saturation (Rowan &Wuiff, 2007). The FGD acted as a wrap-up and also allowed for validation through triangulation on major categories of data generated through the interviews.

Data were coded to come up with categories. Emergent themes or concepts were identified and re-coding was done to refine categories (Baskarada, 2014). FGD data were compared with interview data, and areas of concurrence and divergence were identified and interpreted in the context of research questions. This enhanced trustworthiness of findings.

3. RESULTS AND DISCUSSION

This study investigated, visually challenged pre-service teachers' perceptions of inclusivity in Communication and Information Science Education, based on reflections on their educational experience in the context of ICT use for teaching and learning, and in life in general. The findings are presented under the following sections:

1. Cell phones and Toys
2. The New Curriculum and VILs Needs
3. ICT as a learning tool for VILs
4. VI people Lagging behind on ICT integration Globally
5. ICT for VILs versus SDGs
6. Supportive Teaching and Learning for VILs
7. Challenges experienced by VILs in ICT use for Teaching and Learning
8. Document Analysis
9. Focus Group Discussion

a. Cell phones and Toys

Asked what the best time for VI people to learn how to use ICT is, VI pre service teacher Mary said:

> *In this 21st century, children start interacting with ICT as early as preschool age by playing with cell phones of their relatives which are mini-computers. Non-VI children play with electronic toys and they watch TV which shows various uses of ICTs. When non-VI children go to schools they already have a foundation from which to base the use of ICT as a tool for learning, while VI children will be lagging behind. VI people should use ICT at early childhood just like non-VI children.*

VI pre-service teacher David who had high competences in ICT use said:

> *One should begin using ICT early especially if you are visually impaired because more time is needed to master skills to use ICT than those who non- VI.*

Another VI pre-service teacher Anna lamented the absence of education policy which makes it compulsory for education institutions (schools, colleges, and universities) to provide appropriate ICT education for VILs.
She said:

> *The ICT education system is not inclusive. When you hear ICT issues being discussed they will be referring to non-VI people and learners. Even now, in the new curriculum, there is no reflection of being inclusive of VI learners in ICT education from pre-school to university level. I have not heard about advocacy for ICT specifically for VILs in the New Curriculum.*

These quotations show that VILs felt excluded in ICT use from preschool to university, yet the Zimbabwean education system seeks to promote education for all (MoPSE, 2015). The grand question begging for an answer is "Does the term the 'all' still have the usual meaning when VILs are excluded? Wittingly or unwittingly its apparent exclusion is present in this education system and should be eliminated.

b. The New Curriculum and VILs Needs

When asked about the view on how inclusive the New Curriculum was with regards VI people in ICT application for learning, pre-service VI teacher Victor said:

> *There is so much advocacy for science, technology, engineering and mathematics (STEM) and implementation of ICT in the New Curriculum implementation, but there is no focus on the inclusion of VI learners. Even when advocacy is done using media like radio and TV there is no mention of the already disadvantaged group of VI people and VI learners.*

Victor's view is vindicated by Zimbabwe's Ministry of Primary and Secondary Education (MoPSE, 2015) Curriculum Framework for Primary and Secondary Education 2015-2022 aim in section 1.6.3 which is to Foster life-long learning through enhancing ICTs and e-learning, but remaining silent on the inclusion of VILs. This is at variance with MoPSE's goal of education for all through inclusion, evidenced by the constant use of the "all learners" in the CFPSE 2015-2022.

c. ICT as a learning tool for VILs

Asked whether he benefits from using ICT as a learning tool pre-service teacher Jacob said:

> *If there is software which can convert documents from the internet to Baillie it will help VI learners to access information on their own. Asking non -VI classmates is a challenge because they will be busy doing their assignments also. Only when they are through in most cases that they will assist. I do not blame them for that because they are also trying to learn just like me.*

Asked further how this can be solved Jacob said:

> *There should be a clear policy on inclusive education which ensures that VI people as a disadvantaged group should be supported right from pre – school in a learning environment supportive, morally and materially to use ICT both for learning and for socialising or communicating.*

From Jacob's responses there is a lot that needs to be done in Zimbabwe to enable VI people to use CIS through application of smart cell phones ICT, both as a learning tool (Olso et al, 2011) and social media.

d. VI people Lagging behind on ICT integration Globally

Asked about whether VI people are moving with times consistent with global trends in using ICT VI pre-service Sam said:

> *I hear people talking about whatsapp and mobile banking, but I do not know exactly what they are. From what I hear people say, they are technologies which I am happy to use if I am assisted to learn how to use them. Because there is no one to regularly help me to learn to use new information and communication technologies, I am often left behind.*

Another VI pre-service teacher Vimbai commented on the same issue as Sam, of moving with times by using current ICTs saying:

> *Buying units of electricity, banking, and communicating through text messages and whatapp by VI people requires first a smart phone with voice prompts and somebody to help me to learn how to perform various functions with the phone. So far nobody is prepared to buy me such a phone.*

The concerns of VI pre – service teachers Vimbai and Sam

indicated the need to review the education policy on ICT education in Zimbabwe, to make it clearly articulate how VI people should be mainstreamed in use of ICT for learning and in life in general, in the context of global trends. More effort similar to gender issues should be put to improve VI people involvement in ICT use.

e. ICT for VILs versus SDGs

Consistent with SDG 4 inclusion and equality in and through ICT education is the cornerstone of transformative education agenda. No education target should be considered met unless met by all (UNESCO, 2017). However, from VI pre-service teachers Anna, Jacob, Victor and Vimbai's responses, VI people are being left out in promotion of quality education though equitable education and lifelong learning opportunities for all, with regard ICT (Bagon, Gačnik & Starčič, 2018). Therefore, there is need to make necessary changes in education policy in Zimbabwe in order to focus effort on VILs, to ensure they are not left behind (UNESCO, 2017).

f. Supportive Teaching and Learning for VILs

Asked on views with regards to the support VI pre-service teachers got in using ICTs for learning at college T and teaching in schools during attachment teaching practice (ATP), pre-service teacher Tendai said:

> *Very few fellow students are willing to help. Most students do not assist, so this does not give me and other VILs the support we need. It motivates morally if those around you support you.*

On support college T gave to the VI pre-service teachers ICT use for their learning and a teaching and learning tool in their lessons VI pre-service teacher Blessing who responded saying:

> *The computers we use have voice prompt called Job Access With Speech (JAWS) which enables us to access internet and get information we need. However, there is need to increase our computer literacy because some of us started using a computer after coming to college. There is need to start teaching VILs at primary school level how to use a computer, so that they a competent as they progress with learning.*

JAWS is a computer screen reader programme for Microsoft Windows that allows blind and visually impaired users to read the screen either with a text-to-speech output or by a refreshable Braille display.
(https://en.wikipedia.org/wiki/JAWS_(screen_reader)).

> *Responses by VI pre-service teachers Tendai and Blessing reveal that a supportive environment, morally and materially, is crucial in developing high competence and confidence of VI pre-service teachers in ICT use both as learners while resident at college, and as teachers while on ATP for learning and in life. This concurs with Du Toit (2015) who observes that the Education for All Global Monitoring Report (2013/ 2014) states that an education system is only as good as its teachers. Therefore VI pre-service teachers should be fully supported with relevant resources if their inclusion to be realised. This avoids de jure inclusion and de facto exclusion, whereby the VILs are physically in the classroom, but not fully catered for educationally (Nyoni, Marashe and Nyoni , 2011).*

Like any VI person, VILs get the impression of the real world through how the non-VI people interact with them. While the current author is entirely aware of the need to empower the VILs to be citizens like any other, caution must be taken to avoid developing perceptions of a harsh world in the VILs and VI people in general. The VI people see the concrete world through us the non – VI, hence the need to help them conceptualise a good world.

g. Challenges experienced by VILs in ICT Use for Teaching and Learning as:

(a) Pre–service teachers while resident at college

VI pre-service Mary's response when asked about challenges in using internet as ICT for learning, the response was:

> *My challenge is I stated to use a computer when I came to college. Now the challenge is that I need to search for information on internet and type assignments for various subjects of my diploma in education. VI people should learn how to use a computer even at primary school level so that they do not experience the problems I am facing.*

Mary's response concurs with Şimşek, Altum, and Ateş, (2010). Besides, people with visual disabilities face special barriers in using the Internet if assistive technology is not available. Therefore it becomes a futile exercise to provide internet to VI people because they will not be able to use it. This amounts to discrimination which is inconsistent with the UN Universal Declaration of Human Rights, hence assistive technologies should be available to VILs.

(b) Pre – service teachers while on ATP

Samson, a VI pre-service teacher who was specialising in Diploma in Education in Computer studies said:

> *There is a challenge in paying assistants during ATP. The monthly allowance we get was greatly reduced recently, such that without financial help it is a challenge to some of us to pay assistants. The role of assistants is beyond helping us in using ICT as a tool for teaching and learning, but includes all aspects of preparation for teaching like scheming and making detailed lesson plans (DLPs). It includes helping during the actual teaching by implementing instruction as the VI teacher advises.*

There is need to provide VI pre-service teachers with relevant resources at the appropriate time in an effort to remove barriers and create a learning climate which is inclusive. Inclusion in mainstream education is a right, and does not require separate schools or classes. An appropriate learning environment for VILs can be achieved in fully inclusive, properly resourced and restructured mainstream settings which approach education flexibly, and providing opportunities for learning which suit the VILs (CSIE, 2005; Eligi, and Mwantimwa, 2017). This is the kind of learning environment for VILs the education system of Zimbabwe should seek to establish.

h. Document Analysis

In the Zimbabwe Curriculum Framework for Primary and Secondary Education (CFPSE) 2015-2022, MoPSE states that learning skills should be enhanced through developing a range of ICT skills for every learner. Technological skills should be enhanced by learning having a range of basic ICT skills, being able to organise data with ICT, and willingness to learn new ICT skills. In addition learners should have health and safety knowledge to apply technology.

The New Curriculum Framework document of MoPSE (2015) clearly show the need and commitment to have an education system which develop ICT skills from early childhood development (ECD) level to tertiary level. However, premised on the fact that

VILs is a disadvantage group which has faced discrimination not only in education, but in social life in general, the New Curriculum Framework falls short of a clear explanation of how enhancement of ICT should be implemented in schools for VILs to benefit. The term "all learners" used seems to overshadow / mask the individual needs of VILs, such that their special needs are not attended to.

Also, analysis of the CFPSE 2015-2022 shows the following:

The term ICT is used ten times and the term STEM nine times. There are 9 pictures of learners involved in STEM / ICT learning activities. There is also a total of 16 pictures showing people doing various activities. What is of concern is that in all cases there are no representations of VILs. This document is the hub of development and implementation of the envisaged New Curriculum which means the VILs will not be cater for in the implementation of the curriculum.

College T curriculum documents acknowledge the need to use ICT for teaching and learning, managing information, and in life in general. Though VILs pre-service teachers are prepared at college T, there is no mention of ICT specifically for the VI pre-service teachers as a disadvantaged group. This indicates a deficiency in the level of ICT inclusivity at college T.

i. Focus Group Discussion

All the 10 VI pre-service teachers involved in the study concurred that if ICT learning and application begins as early as primary level, one is bound to develop high competence and confidence level in ICT use. Reiterating VI pre-service teacher Tendai's view, all the VI pre-service teachers concurred that a very supportive environment, morally and materially, was crucial in developing high competence and confidence levels of VI persons in using ICT for learning and in social life. Through enough ICT support like JAWS, the current author reports with joy, that one VI pre-service teacher expressed high motivation after getting a distinction in Teaching Practice. Many non-VI pre-service teachers were not able to get such a pass, proving that disability is not inability, but only the teaching and learning environment should be made conducive by removing barriers. This pre-service VI teacher said the ultimate aim is getting a PhD. This is an indication that support for VILs is crucially important.

4. CONCLUSIONS

The purpose of study was to gain insight on Inclusivity of Communication and Information Science Education in a STEM Environment in Zimbabwe, with reference to reflections on educational (from early childhood to tertiary level) and life experiences of visually impaired (VI) pre-service teacher in ICT use.

The willingness by MoPSE to make ICT a component of the curriculum of Zimbabwe is plausible. However, it is concluded from the analysis of MoPSE's policy document, that is the Curriculum Framework for Primary and Secondary Education 2015-2022, that there is no reference to how VILs should be involved in ICT integration as a teaching and learning tool. This was corroborated during interviews and focus group discussion with VI pre-service teachers when they lamented their experience of exclusion from ICT use right from early child development (ECD) stage. Similarly, analysis of college T pre-service teacher education curriculum document revealed that they were silent on how VI pre-service teachers, as a disadvantage group can be assisted to develop competences comparable with their non-VI counterparts.

Recommendations

It is recommended that MoPSE should make it clear in policy how VILs should be catered for by the education system to develop ICT competencies comparable with their non – VI counterparts. Such a policy will guide the whole education system on full inclusion of VILs in mainstreaming of Communication and Information Science (CIS) through ICT.

Educational institutions (teacher preparation institutions and schools), should make individual initiatives to be inclusive in ICT. This may have a net result of sensitising government to craft supporting educational policy.

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