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Learning about or with and through ICTs: A Dilemma of Preschool Education in Zimbabwe

Alice Kuyayama, Novuyo Nkomo

Abstract

Several studies concur that information and communication technologies (ICTs) in early childhood development (ECD) provide multiple opportunities for children (Hatzigianni & Margetts, 2012; Kerckaert, Vanderlinde, & van Braak, 2015). This study aimed to establish the use of ICTs in Zimbabwean preschools. A descriptive survey was employed. Based on the responses of 230 preschool teachers, two types of ICTs use were prominent in ECD. These were: learning about ICTs and learning with and through ICTs. Children were more engaged in learning about ICTs at government, council and mission schools, whereas at trust schools children were exposed to both and were afforded considerable opportunities to access the curriculum with/through ICT oriented instruction. Government, council and mission schools lacked ICT tools. Some ICTs were broken down and others absolute which limited access by both ECD teachers and learners.

Keywords: Information and communication technology, ICT, Early childhood development, Preschool education

Introduction

The studies point out that ICTs present space for exploration and discovery for young children, offers challenging activities and responds to children's curiosity. Bolstad (2004) asserts that ICTs offer new opportunities such as stimulating creativity and play, intellectual development, social interaction. Notwithstanding this debate, research on use of ICTs in ECE is still limited (Kerckaert, Vanderlinde and van Braak, 2015). Its thus important to explore the status quo in Zimbabwe with regard to use of ICTs in learning and development of children at ECD level.

Zimbabwean Context

This study was conducted in Harare urban primary schools, in Zimbabwe. In 2015, the Ministry of Primary and Secondary Education (MoPSE) launched an updated Curriculum. The MoPSE developed this Curriculum Framework for Primary (including Early Childhood Development) and Secondary school levels. The decision to develop the Curriculum Framework was made in the context of the government's focus on preparing

Zimbabwean learners for the needs of the 21st century and trends in the educational global village (MoPSE Curriculum Framework for Primary and Secondary Education 2015-2022).

In line with this study, one of the competences specified in the Curriculum Framework is that Early Childhood Development (ECD) learners should demonstrate proficiency in basic operations in technology and technical skills areas. In addition, Information and Communication Technology (ICT) is a standalone Learning Area (discipline) of ECD level learners. In this discipline, learners are exposed to and manipulate ICT tools; whereby they develop technical skills through games, coloring, ordering and communication. Overtime, they learn about appliances, their different purposes as well as appropriate use and care. ICT is also infused as a medium of instruction across the ECD learning areas to enhance teaching and learning.

Opportunities of ICTs at Early Childhood Development Level

There are significant pedagogical differences between learning in the ECD (pre-primary) and junior (primary) school class. The curriculum is less prescriptive and there are different standards of professional practice. There is more emphasis on learning through play and minimal formal and teacher-directed activities. This constitutes child- centered education. That way, infusion of ICTs into the ECD curriculum entails a completely different approach in junior primary education. According to Kerckaert, Vanderlinde, & van Braak (2015), child-centered learning in ECD translates into hands-on experiences with ICTs as one of many possible activities in free play. Free play affords ECD learners choice of when and how to work on an ICT tool.

While teachers organise and support directed activities, this is not common in activities with technology, as teachers want to avoid too much instruction, lest they overshadow the child-centred approach. Morgan (2010) points out that the use of the interactive whiteboard does not provide interactive (playful) learning experiences. The teacher directs (controls) the teaching and learning process and technology is mostly used for instruction. This undermines ICT-oriented child-centered pedagogy. In the same vein, Terreni (2010) asserts that free play facilitates active and creative engagement which yields sustained children's manipulation of technologies.

Several authors provide a synopsis of opportunities of ICTs for ECD level learners. This illustrates that ICTs offer multiple opportunities and can transform classroom practice. The ICT opportunities are as contained in Table 1.

Either online or in software form, Table 1 shows that ICTs can provide situations for learners that mirror real life experiences. Prensky (2005) coins to ECD children as "digital natives" with regard to the confidence that young learner exhibit when using ICTs. This is a result of them being surrounded and immersed in technological experiences in their daily lives. Pedro (2007) dubs young children "new millennial learners" that must be nurtured to adapt to the ever-changing technologies. The question remains on how the "millennial learners" are engaged in technologies in Zimbabwe.

Table 1. Opportunities offered by ICTs to ECD Level Learners

Author	**Category / Narration**	**Specific activities**
Bolstad (2004)	ICTs can add an extra dimension to the play activities of young children. Children can use ICT in realistic and creative socio-dramatic role-play, while learning the correct vocabulary and to use the forms of ICT.	Using internet to locate information or resources, sparked by children's interest in an idea or topic Playing or learning alone, with peers or adults
Kalas (2010)	ICT can facilitate language development and mathematical thinking of young children, through shifts between words and pictures, repetitive software packages, drawing programs or computer manipulation.	Children using computers to play games, listen to stories, or draw, paint pictures I games or role play activities
Bolstad (2004) Kalas (2010)	ICTs can provide unique opportunities for scaffolding and supporting learners with special learning needs, or learners from culturally or linguistically diverse backgrounds	Taking digital photos, videos, or audio recordings of activities and reviewing these or sharing with parents
Clements & Sarama (2003) Kalas (2010)	When ICTs are used in spontaneous (unstructured) learning and playing in the classroom, it can facilitate social interaction However, adult guidance is required for learners to benefit most from the ICT environments	Using ICTs to build portfolios of children's work, to use for evaluating progress in children's learning and development
Kerckaert et al, 2015).	ICTs have learner motivational aspects. The speed, colours, dynamic presentation and instant feedback appeal to learners	

Statement of the Research Problem

Infusion of ICTs in the education is a complex process that is influenced by many factors (Inan & Lowther, 2010). The researcher is a product of the Teacher Development program and has noted that there is limited research on use of ICTs at ECD level in Zimbabwe. Five years have elapsed after the launch of the MoPSE Curriculum Framework for Primary and Secondary Education which directs infusion of ICTs in the ECD curriculum. It is also important to establish the extent to which the "digital natives" are learning about and with/through ICTs at ECD level and to explore factors that bring about the prevailing scenario in Zimbabwe.

Research Questions

1. What ICTs are available for ECD classes in primary schools?
2. How are ICTs used to deliver the ECD curriculum?
3. What factors influence use of ICTs in implementation of the ECD curriculum?

Methodology

The study was based on a survey research design.

Key Concepts

ICT: ICT denotes infrastructure and resources used in the context of education, referring to implementing ICT tools, techniques and equipment to support teaching, learning and other cognitive activities. It is anything which allows people to get information, to communicate with each other using electronic or digital equipment. This includes: computers, digital cameras, creativity and communication software and tools, the internet, telephones, fax machines, interactive stories, computer games, programmable toys, video conferencing, electronic whiteboards etc.

Infusion of ICTs: This refers to how ICTs are being used by teachers to enhance and support existing classroom practice, and how such use may be transforming learning activities.

Developmental appropriateness: The concept refers to the idea that the use of ICT should be challenging, but also attainable for most children of a specific age or certain children.

Results

ICT Tools (Gadgets)

Teachers were requested to indicate, on the questionnaire, the ICT tools for teaching and learning available at their schools. The information on ICT tools is contained in Figure 1. Figure 1 indicates that 56 (93.3%) of teachers from government, 42 (95.5%) from council, 10 (100%) from mission and 12 (100%) from trust schools reported that they had computers for use in teaching and learning. As for projectors, 15 (25.0%) teachers working at government, 13 (29.5%) at council, 3 (30%) at mission and 12 (100%) at trust schools reported that projectors for use in teaching and learning were available at their schools. With regard television, 56 (93.3%) of government school, 41 (93.2%) council school, 8 (80%) mission school and 12 (100%) trust school teachers indicated that they had televisions for use in teaching and learning. A total of 2 (3.3%) government school teachers, 1 (2.2%) council school teacher, 1 (10%) mission school teacher and 12 (100%) trust school teachers indicated that interactive boards for use in teaching and learning were also available at their schools. Furthermore, 100% of the teachers across the different types of schools indicated that computerized toys for teaching and learning were available at their schools.

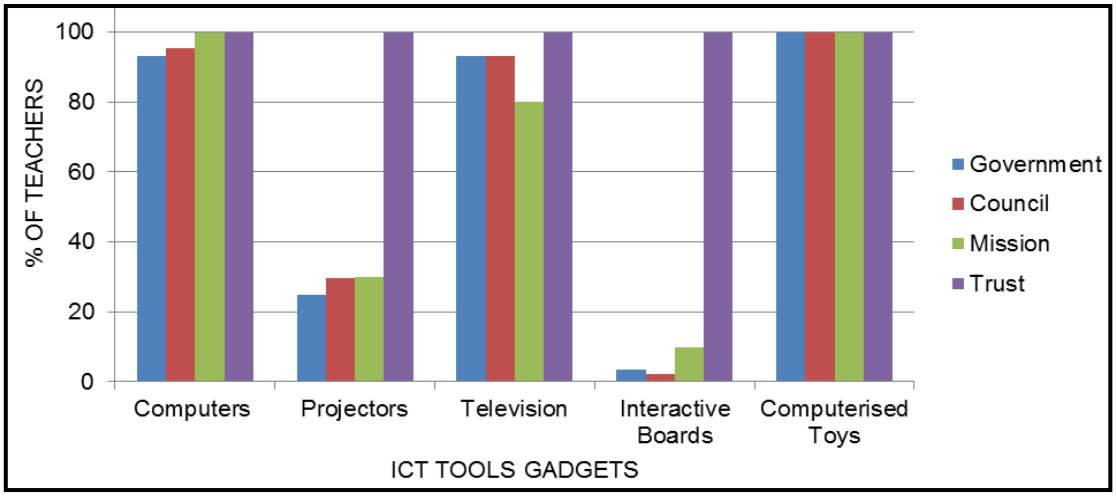

Figure 1. Responses of Teachers on Available ICT Tools

Figure 1 reveals that computerized (programmable) toys were available for use in teaching and learning at all types of schools. All the trust school teachers had computers, projectors, televisions and interactive boards for use during learning and instruction. On the contrary, most of the GCM school teachers did not have projectors and interactive boards for teaching and learning purposes. These results implied that trust schools were better resourced than the GCM schools in terms of ICT tools for use in teaching and learning. School documents (individual class inventories, the TIC's inventory, and school inventory) confirmed information solicited through the questionnaire. Similar information was obtained through observations by the researcher.

It was important to establish why there were disparities on ICT tools (equipment) available in schools. Through interviews, the following responses were obtained.

One ECD teacher at a trust school said:

Here, at our school, each teacher has a laptop procured either by the school or parents. We however, don't use laptops every time during teaching and learning because we have abundant alternative gadgets for that purpose. We all have tablets which serve the same purpose as the laptop and desktop. Tablets are more portable and hence more convenient for us teachers

Another ECD teacher at a trust school remarked:

I am happy. We've modern ICT tools such as interactive boards and modems. These tools are expensive but our SDA does not mind the price as long as what the school requires benefits their children. As you know, our learners are from rich families.

An ECD teacher at a government school commented

Projectors and interactive boards are not available at our school because of financial constraints. We have computers and televisions although they are not adequate.

One ECD teacher at a mission school has this to say:

Teachers at this school do not have ICT tools such as televisions, interactive boards and projectors dedicated to their classes. We take turns to use the ICT tools.

An ECD government school teacher remarked:

I have never set my eyes on an interactive board. I don't know with other schools. As for televisions, projectors and computers; our school does not have enough for classes to plan ICT-aided lessons independently. Teachers have to consult the ICT tools' roster so that they know when they can use a particular ICT tool in teaching and learning

These interview responses were confirmed through document analysis. It was noted through document analysis (Purchase Ledger & class inventories) that Trust School teachers had a variety of ICT tools because they got funding from industry (some of their learners' parents' workplaces), renowned sponsors from western countries, individual well-wishers and in a few cases, from government. As for GCM schools, only a handful of the teachers had class projectors and interactive boards. Through observations, it was noted that ICT tools such as computers, televisions and computerized toys reported as available, were shared across three or more classes. Others were absolute but given as available. This further indicated that trust schools were better equipped with ICT tools than GCM schools.

Class Size

Class size has a bearing on how teachers use ICTs as it influences teacher's methods and management skills. According to MoPSE Statutory Instrument 106 of 2005, the ECD class should have 20 learners. The researcher, thus, solicited information from teachers to establish the class size of ECD classes [Figure 2].

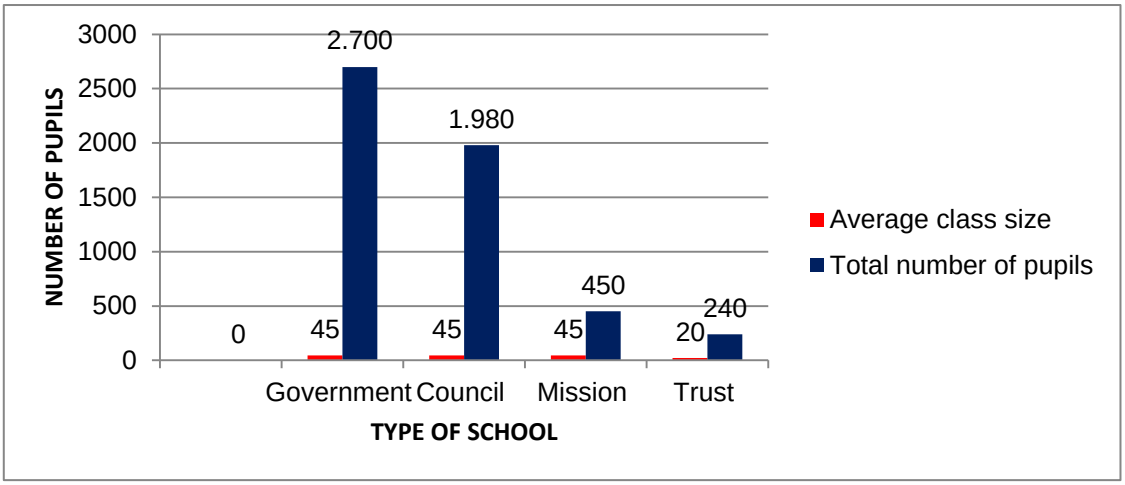

Figure 2. Responses of Teachers on ECD Class Size

Figure 2 shows that in HMP; government, council, mission and trust schools had a total enrolment of 2 700, 1 980, 450 and 240 learners respectively. The government schools had the largest number of learners, followed by council, mission and trust schools. However, the large number of learners, for example, at government and council (GC) schools, was not a result of over-enrolment, but a reflection of the number of GC in Harare Metropolitan Province. It is noted from Figure 2 that GCM schools had an average class size of forty five (45) learners while trust schools had twenty (20) learners.

This information implied that GCM schools were over-enrolled whilst trust schools had conformed to the required enrolment (MoPSE Statutory Instrument 106 of 2005). Observation and school documents (teachers' lesson plan evaluations and supervision reports) confirmed this information but also revealed that teachers refrained from using ICTs that required learner individual attention. Lack of use of ICTs that required individual attention to learners was a setback to hands-on experiences with ICTs by learners. Contrary to the situation at GCM schools, small classes at trust schools afforded teachers quality time to assist learners acquire relevant

skills using ICTs. This minimized learner frustration with ICTs and enhanced their confidence. It was noted that learner confidence with ICTs, motivated trust school teachers to employ the child-centered approach (learning through play).

ICT Tool-learner Ratio

ICT tools are an important component of the teaching and learning process as they provide learners with concrete materials to acquire knowledge and skills in a given subject. The ICT tool-pupil ratio is equally critical as it determines the magnitude of access by learners during teaching and learning. Table 2 summarizes information collected through document analysis (teachers' class inventories) verified through observation. The summary indicates the quantities of ICT tools per type of school, the ICT tool-learner ratio and corresponding remark. The remark indicates if the ICT tools were adequate or inadequate.

Table 2. Responses of Teachers on ICT Tool-learner Ratio

ICT tools	**Type of School**											
	Government			**Council**			**Mission**			**Trust**		
	Qty	T- L rto	R	Qty	T- L rto	R	Qty	T- L rto	R	Qty	T- L rto	R
Cop toys	542	1:5	A	424	1:5	A	75	1:6	A	490	2:1	A
Cops	1 022	1:43	NA	952	1:36	NA	150	1:39	NA	254	1:1	A
Proj	40	1:68	NA	24	1:83	NA	7	1:64	NA	12	1:20	A
TV	56	1:48	NA	41	1:48	NA	8	1:56	NA	12	1:20	A
IB	2	1:350	NA	1	1:1980	NA	1	1:450	NA	11	1:22	A

Key:

Cop toys……Computerised toys
Cops……..Computers
Proj……..Projectors
TV……..Television
IB……..Interactive boards
Qty……..Quantity
T-L rto……..ICT tool-learner ratio
R……..Remark
NA……..Not Adequate
A……..Adequate

Table 2 shows that the majority of the different ICT tools were available for use in teaching and learning at GCMT schools. However, quantities of ICT tools per type of school varied. Computerized toys were observed as adequate (A) with a ratio of 1 computerized toy to 5 learners across the government, council, mission and trust schools. Computers, projectors, televisions and interactive boards were observed as not adequate (NA) at GCM schools. As for computers, the ratios were as follows: 1 computer to 43 learners at government schools, 1 computer to 36 learners at council schools and 1 computer to 39 learners at mission schools while at trust schools the ratio was 1 computer to 1 learner. With regard projectors, the ratios were: 1 projector to 68 learners at government schools, 1 projector to 83 learners at council schools and 1 projector to 64 learners at mission schools while at trust schools the ratio was 1 projector to 20 learners.

In the case of televisions, the ratios were as follows: 1 television to 48 learners at both government and council schools, 1 television to 56 learners at mission schools while 1 television was used by only 20 learners at trust schools. As for interactive boards, the ratios were: 1 to 1 350 learners at government schools, 1 to 1 980 at council schools and 1 to 450 learners at mission schools while 1 interactive board was used by an average of 22 learners at trust schools. The pattern that emerged from these teacher responses was that trust schools had adequate ICT tools for use in teaching and learning. On the contrary, GCM schools were found with inadequate ICT tools. It was established through observation that the shortage of ICT tools was either due to low quantities or lack of maintenance. This situation was confirmed by a government school ECD teacher as contained in diagram below.

Government school ECD teacher said:

Some of our computers and televisions are absolute. A total of 6 computers out of 20 are down. We have 2 televisions for 4 classes. 1 of the televisions is down. All these ICT tools have not been maintained since they were bought in 2011. Think of the many learners we have. So many learners share one computer.

Further confirmation was obtained from:

Council school ECD teacher who remarked:

We only have 8 computers and 2 TVs here as you have seen. Five (5) of the computers out of 8 have broken down. However, the TVs are all functional. Please note that these ICT tools are shared among 6 ECD classes which have an average of 45 learners each. More so, some so-called computers are just garbage from the school computer lab. They were found irreparable and they were dumped here for children to use in play.

A similar remark was given by:

Mission school ECD teacher who said:

The ICT gadgets we have here are shared by all the classes. For example, we have only 20 functional computers in the whole school. We have 27 classes from ECD "A" to Grade 7, each with an average class size of 50 learners. This means 1350 learners and 27 teachers share 20 computers. These computers are also adult- size. They are not appropriate for ECD learners, even the furniture.

Contrary to the information obtained from GCM schools,

ECD Trust School teachers through Focus Group Interviews said:

Our learners do not share computers. We have a one-to-one computer-learner ratio. The anti-virus software is updated on a regular basis. We do not have anything like absolute computer, television or interactive board.

With regard to information collected on ICT tool-learner ratio, indicators were that trust schools had low ICT tool-learner ratio. This meant possible ICT playful experiences by learners. As for GCM schools, the ICT tool-learner ratio was very high and access to ICT tools was problematic. To a larger extent, interactive learning experiences with ICTs were limited for GCM ECD learners. In this situation, trust schools were in a better position than GCM schools to engage children in learning with/through ICTs.

Frequency of Use of ICT Tools

Over and above adequate ICT tools, free play with ICTs is an indicator of learning with/through ICTs. According to UNESCO (2013), learning with/through ICTs is possible when children are exposed to playful learning experiences on a daily basis. Data were collected to ascertain how frequently playful learning experiences with ICTs were afforded ECD learners. This data were collected through document analysis (teachers' lesson plans) [Table 3].

Table 3. Responses of Teachers on Frequency (F) of Use of ICT Tools

ICT tools	**Government**		**Council**		**Mission**		**Trust**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Computerized toys	D	100	D	100	D	100	**D**	100
Computers	W	91.7	W	95.5	W	100	D	100
Projectors	2M	25	2M	29.5	2M	30	W	100
Televisions	W	93.3	W	93.2	W	80	D	100
Interactive Boards	M	3.3	M	2.2	M	10	D	91.7

Key:

D……daily *2W……twice per week*

W……weekly *2M…… twice per month (fortnightly)*

M……monthly

Table 3 shows that 100% of teachers stationed at GCMT schools interacted with computerized toys on a daily basis. As for computers, 91.7% of teachers at government schools, 95.5% of teachers at council schools and 100% at mission schools provided free computer-play weekly, while 100% teachers at trust schools exposed learners to free computer-play daily. Furthermore, 25% government school, 29.5% council school and 30% mission school teachers reported that they used projectors fortnightly, whereas 100% trust school teachers used the same tool on a weekly basis. A total of 93.3% teachers at government, 93.2% council and 80% mission schools used televisions weekly. Only 3.3% government school, 2.2% council school, and 10% mission school teachers used interactive boards once a month, while 91.7% trust school teachers used the same tool daily. These results indicated frequent use of computerized toys, computers, televisions and interactive boards in interactive learning experiences at trust schools. Frequent playful experiences with computers, televisions,

projectors and interactive boards were rare at GCM schools. This information implied more learning through play with ICTs at trust schools and lack of it at most GCM schools.

This information was confirmed by document analysis (class inventories, teacher lesson plans and teacher supervision instrument). School documents also revealed that the use of the computerized toys, computers, televisions and interactive boards was play-oriented because these tools were adequate. It was also noted that trust school teacher supervision instruments had a section which enabled the school head to monitor child-centered learning using ICTs. This compelled teachers at trust schools to engage children in interactive learning experiences with ICTs. As for most GCM schools, the teacher supervision instrument was silent on ICTs and there was lack of enforcement in this regard. This meant that the majority of teachers stationed at GCM schools were not compelled to provide learners with hands-on experiences with ICTs. Lack of play-based learning with ICTs was also confirmed by interviews with teachers [Figure 4].

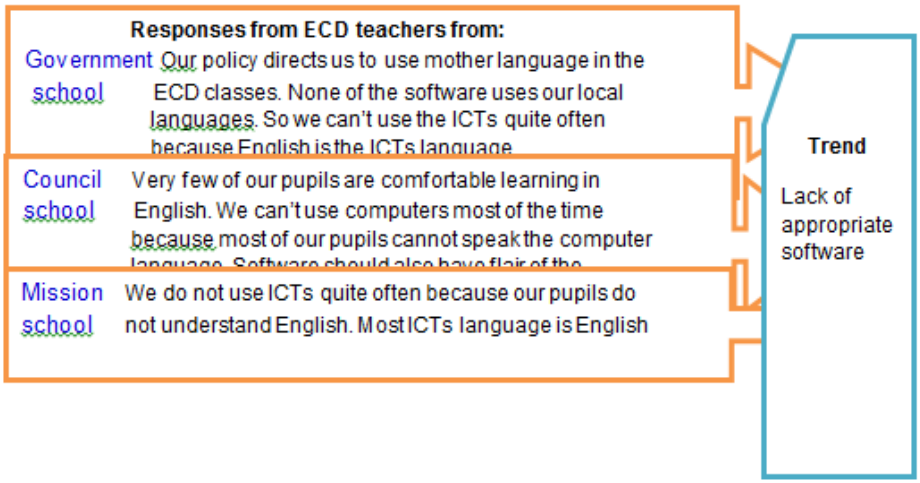

Figure 4. Responses of Teachers on Lack of Frequent Use of ICTs

The trend that emerged from the teacher responses was lack of appropriate software which used ChiShona. The software was referred to as inappropriate because its dominant language was English Language. It should be noted that the dominant home language of children in Harare Metropolitan Province was ChiShona. As a result the majority of the pupils at GCM did not follow most of the software content. That being the case, ICTs could not be effectively used in free play sessions at GCM schools as the case at trust schools where the majority of pupils were conversant with English language. As a result, the language barrier compromised spontaneous learning experiences with ICTs at GCM schools. Quite often, teachers directed ICT-oriented activities at GCM schools which, defeated learning with/through ICTs.

Location of ICT Tools

The location of the ICT tools determines the extent to which they are accessible for use in interactive (playful) learning experiences. Information was sought from teachers on which room at the school the ICT tools were located. Data collected from teachers indicating location of ICTs at their school is contained in 4.

Table 4. Responses of Teachers on Location of ICT Tools

ICT tools	Type of school							
	Government		Council		Mission		Trust	
	L	%	L	%	L	%	L	%
Computerized toys	C/R	100	C/R	100	C/R	100	C/R	100
Computers	CLab	91.7	CLab	95.5	CLab	100	C/R	100
Projectors	Sofc	25	Sofc	29.5	Sofc	30	C/R	100
Television	C/R	93.3	C/R	93.2	C/R	80	C/R	100
Interactive Boards	CLab	3.3	CLab	2.2	CLab	10	C/R	91.7

Key:

L……..location *C/R…….classroom*

CLab…..computer laboratory *Sofc……school head's office*

Across GCMT schools, 100% of the teachers reported that computerized toys were housed in the classrooms. A total of 91.7% of government, 95.5% of council and 100% of mission school teachers indicated that computers were found in the computer laboratory. The situation was different at trust schools where 100% of the teachers reported that computers were mounted in the classrooms. With regard to projectors, 25% government, 29.5% council and 30% mission school teachers indicated that projectors were housed in the school head's office, while 100% trust school teachers said their projectors were found in a storeroom within the classroom.

The majority of teachers, that is, 93.3% from government, 93.2% from council, 80% from mission schools and 100% from trust schools reported that televisions were housed in the classroom. Interactive Boards were reported to be found in the computer laboratory by only 3.3% teachers from government, 2.2% teachers from council and 10% teachers from mission schools. Teachers from trust schools (91.7%) reported that interactive boards were mounted in the classroom.

These results showed that computerized toys and televisions were housed in the classroom across GCMT schools. Placing these ICT tools in the classrooms implied that they could easily be accessed for use in concrete and for 'playful' learning. The majority of ICT tools (computers, projectors and interactive boards) were not housed in the classroom at GCM schools. They were either in the computer laboratory or school office. It emerged that ICT tools were not secure in the classrooms at GCM schools.

As for trust schools, ICT tools were housed in the classrooms because security measures were put in place. This information was confirmed through observations whereby there were no burglar bars on windows and screens on classroom doors and above the ceiling as the case with the school office and computer laboratory at most

GCM schools. The situation was observed as different at trust schools where the classrooms, computer laboratories and the school office were highly secured with burglar barred windows, screen doors and ceiling as well as an alarm system. Trust schools even employed a security company that deployed a security guard throughout the day and night.

Interviews with teachers confirmed that location of ICT tools outside the classroom inhibited most teachers at GCM schools to employ active learning using ICTs [Figure 5]. Trust school teachers used ICT-based active learning strategies in most of their lessons because the ICTs were adequate and housed in the classroom.

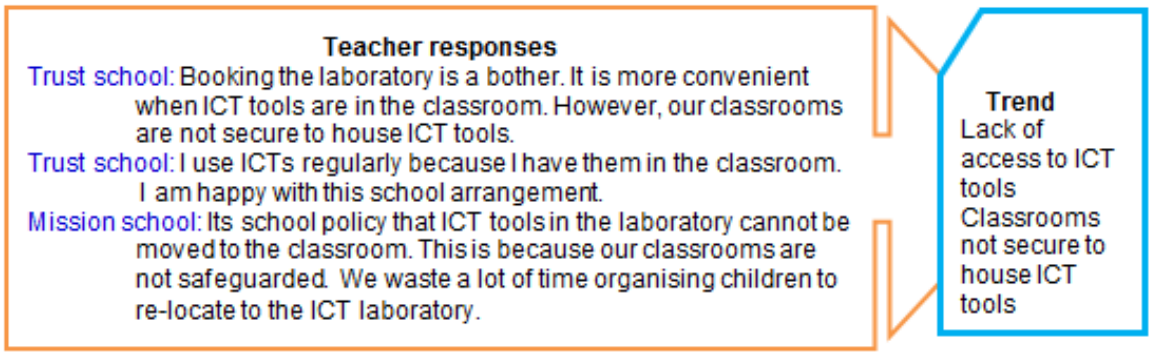

Figure 5. Responses of Teachers on the Location of ICT Tools

The trend that emerged from teacher responses in Figure 5 was lack of security of ICT tools in the classroom at GCM schools. This in turn limited access to ICT tools by both pupils and teachers at GCM schools. It was also noted that the classroom was the most preferred location of ICT tools because it guaranteed ease of access to tools enabling learning with/through ICTs. High security at trust schools enabled housing of ICT tools in the classroom, which enhanced access to ICT tools and facilitated hands-on experiences with ICTs to learn different subjects.

Discussion

ICT Tools (Gadgets)

Access to technological resources (ICT tools) is one of the factors that influenced teachers to afford learners hands-on experiences with ICTs (Kerchaert et al, 2015). This means that access to ICT tools, in this case computers, projectors, televisions, interactive boards and computerized toys is key to learn about and with/through ICTs. The results of the study indicated that ICT tools were available at government, council, mission and trust schools.

Although these ICT tools were available it is important to note that availability alone did not translate into effective utilization of the ICTs. There were other interlocking factors that had to be considered. These were: ICT tool - pupil ratio and class size. This is in line with UNESCO-UIS (2013) who describes schools acquisition of ICT tools as just the beginning of ensuring effective use in delivery of the curriculum.

ICT Tool-learner Ratio

This study revealed that the computer-learner ratio at GCM schools was too high. It was as high as 1:40 on average. In Zimbabwe, the 2010-2014 strategic plan for the Ministry of Information and Communication Technology was to have one computer per class. An ECD class has 20 learners by 2014. However, considering that it was now 2018, this dream was far-fetched as revealed by this study since an average of forty learners shared a computer. Developed countries such as Norway, Singapore and Canada require a ratio of 1 learner per computer or computerized toy (Ghavifekr & Rodsey, 2015).

It was also established that even the other ICTs such as televisions, projectors and interactive boards were not adequate at GCM schools. According to UNESCO (2011) ICT in education standards, GCM schools were therefore, not likely to effectively use ICTs in teaching and learning. Contrary to the situation at GCM schools, trust schools had adequate ICT tools with very low ICT tool-learner ratios. For example, the learner-computer ratio was 1:1 which matched some developed countries such as Canada and Norway (Ghavifekr & Rodsey, 2015). This indicated that learners could spend significant time manipulating computers without obstacles such as waiting for their turn as was the case at GCM schools. There was, therefore, provision for maximum learner-ICT tool interaction (child-centered learning using ICTs) at trust schools.

It was also noted that besides lack of ICT tools at the majority of GCM schools, the available computers were not child-sized. This created an uncomfortable sitting posture for the learners when they manipulated the computers. Some learners had to manipulate the computers whilst in a standing position which was uncomfortable. As a result, some learners abandoned the learning activities with ICTs midway and started fidgeting. The computers and the furniture on which the computers were mounted were also not colourful. This was inconsistent with ECD principles outlined by Montessori in Crain (2010) who advocated for colourful child-sized learning materials which resonated with learners' cognitive level; as well as lure the learners' attention.

In some cases, teachers reported that ICTs were available and adequate, particularly computerised toys. However, some of these computerised toys were broken down, meaning they were no longer functional ICTs but ordinary play materials. When used in teaching and learning, these broken down ICTs could not achieve the desired learning outcomes. It was also found that at some GCM schools, ECD classrooms were treated as ICT garbage sites where all obsolete and broken down ICTs were dumped for use in play by ECD learners. There was a misconception that ECD learners were too young to use ICTs. They only required ICTs for play purposes without any educational value. In view of this finding, the ICT-learner ratio was very high since some of the ICTs were obsolete or broken down. High ICT-learner ratio limited learners from learning through hands-on which is contrary to the philosophies of the pioneers of ECD education who emphasised concrete learning experiences (Comenius, Pestalozzi, Montessori & Rousseau cited in Crain, 2010). According to Dale cone of learning (Anderson, 2013), ICTs lend themselves well to the learning style of ECD learners. However, lack of access to functional ICTs as the case at some GCM schools, inhibited effective use of ICTs in teaching and learning.

Class Size

This study found that the teacher-learner ratio at GCM schools was 1 teacher to 45 learners. This ratio was high because in Zimbabwe, the required ECD teacher-learner ratio is 1 teacher to 20 learners (Statutory Instrument 106 of 2005, Principal Director's Circular Minute Number 20 of 2011). To attain effective use of ICTs, the class size should be commensurate with the number of ICT tools (UNESCO, 2011). The teacher-learner ratio was also compounded by teachers at government and mission schools who connived to co-teach their learners in one classroom in an effort to avoid hot-sitting. In such situations, classes were as large as 80-90 learners which created disciplinary problems particularly when learners manipulated ICT tools. More so, large classes inhibited close monitoring of and individual attention to learners by the teacher as advocated by Montessori in Crain (2010).

In a bid to minimize challenges with class control, such teachers adopted the lecture method using PowerPoint or beaming a story-teller which was a misconception of implementation of ICT policy in teaching and learning. According to UNESCO (2015), use of ICTs in teaching and learning involves the learner's manipulation of ICT tools, which can be referred to as child-centered learning. Lecturing using ICT tools as observed in this research, promoted teacher-centered learning which did not allow learners' active involvement through hands-on experiences with ICTs. In such situations, the classrooms at some government and mission schools were not conducive to effective use ICTs in teaching and learning. With regard to trust schools, it was noted that the class size was 20 learners on average; and ICTs such as computers, interactive boards, and televisions resonated with the class size. However, the findings of this study contradicted that of Konyana and Konyana (2014) who reported that ICT tools such as computers were inadequate in Zimbabwean schools, as there was an exception with trust schools.

According to UNESCO (2010), teachers are motivated by teaching small classes. This is consistent with a study by Agbo (2015) at Australian schools where small classes as well as the provision of varied and adequate ICTs motivated teachers to effectively use the ICTs in teaching and learning. Thus, equipping schools with adequate ICT tools is a factor that influences effective use of the ICTs in learning and instruction. Class-size is important at ECD level because children at this developmental level learn best through "action learning" techniques which involve sense perceptions. Such form of learning requires concrete technological materials (Dale's cone of Learning, Anderson, 2013). Even working within the Zone of Proximal Development (ZPD), where the teacher (expert) assists learners (novices) to work just beyond their capacity to solve problems requires adequate cultural tools, (Vygotsky, 1978 cited in Maheshwari, 2016), in this case adequate ICT tools.

Frequency of Use of ICT Tools

The perceived benefits of frequent use of ICTs in teaching and learning are revealed by Dale's Cone of experience (Corpuz & Salandanan, 2014) where frequent or repetitive learning with/through ICTs yield positive learning outcomes of a specific concept or skill within a curriculum area (subject). This study found that use of ICT tools such as computers, televisions, projectors and interactive boards was not frequent at GCM schools but

quite frequent at trust schools. It was noted that the Teacher Supervision Instrument across schools was identical since it was produced and distributed to schools by the Ministry of Primary and Secondary Education. Trust schools went an extra mile to produce individual School-Teacher Supervision Instruments, which enabled the head to audit the teacher's frequency of use of ICTs in teaching and learning. This compelled teachers at trust schools to frequently engage children in both learning about and with/through ICTs. In other words, frequent use of ICTs in ECD classes, at trust schools, was enforced through the Teacher Supervision Instrument.

Frequent use of ICT tools at trust schools increased the teachers' and learners' chances to familiarize and gain confidence in using ICTs during learning and instruction. This concurs with Fagan (2014) who reported that frequent use of ICTs by both teachers and learners enable them to gain experience and increase their confidence in learning with/through ICTs. This implied that trust school teachers had an edge over their colleagues at GCM schools with regard to effective use of ICTs in delivery of the ECD curriculum.

Location of ICT Tools

Bolstad (2004) cited in the New Zealand Council for Educational Research (2014) found that learning with/through ICTs was more effective in education settings where ICT tools were part and parcel of the classroom resources. This research found that ICT tools at most GCM schools were housed in the ICT laboratory or school head's office. Housing ICT tools outside the classroom limited teachers from frequently engaging learners in learning with/through ICTs. The learners had, at times, to withdraw from the classroom to access the ICTs housed in the computer laboratory. However, lessons in the computer lab were limited to "learning about ICTs", especially computer operational skills. In other situations, teachers found signing up for use of the computer laboratory and collection of gadgets from the school head's office cumbersome and inconvenient. As a result, some teachers and learners could not use the ICTs quite often during their class lessons due to limited access.

Where ICTs were adequate and accessible in the classroom, as in the case of trust schools, teachers frequently afforded learners hands-on experiences in both learning about and learning with/through ICTs. This finding resonates with UNESCO (2015) who found that technologies were widely available and accessible in the classroom, in developed countries such as Norway, UK and US. Ghavifekr and Rosdy (2015) are of the view that ICTs in the classroom are highly accessible and have high probability of being utilized in teaching and learning. Thus, location of ICTs is a factor that determines the effective use of the ICTs in delivery of the ECD curriculum.

ICT Software

This study also revealed that over and above limited ICT software at GCM schools, the software was also inappropriate for the ECD learners. The dominant language for the software was English not ChiShona which was understood by most learners in Harare Metropolitan Province. This finding was also contrary to the Zimbabwe language policy that directs schools to teach ECD learners using their home language (MoPSE,

2015). Such a situation revealed contradictions between policy stipulations and policy implementation. As was reported by the majority of teachers at GCM schools, ECD learners faced challenges in understanding software content. That being the case, they got frustrated during learning which destroyed their interest to learn with/through ICTs. As a result, learners shunned ICTs, thereby undermining the use of ICTs in ECD curriculum implementation as specified in the MoPSE Curriculum Framework for Primary and Secondary Education 2015-2022.

Similar findings were obtained by Hennessy et al. (2010) who studied the use of ICTs in Tanzanian primary schools. Hennessy et al. (2010) found that the language of instruction for ECD learners in Tanzania was Kiswahili and English was taught as a subject, not a medium of instruction across different subjects. The challenge was that Kiswahili constituted less than 2% of the ICT software content. Conversely, over 95% of the Tanzanian ECD learners could only speak and read in either Kiswahili or other local languages. This meant, learners did not follow most of the software content even though they had access to it. In the process, the learners were not keen to use ICT software due to the language barrier. This in turn undermined the effective use of ICTs in teaching and learning.

Contrary to the situation at GCM schools, trust schools had adequate and developmentally appropriate ICT software for use by ECD learners. It was established that the dominant language of instruction at trust schools was English. It was noted that the learners were conversant with the English Language and the software exposed learners to experiences they were familiar with. As a result, trust school learners used the software with ease. This confirmed results for a study by Hennessey, et al. (2010) that, contextualizing software promotes effective use of ICTs in teaching and learning. By contextualizing software, Hennessey, et al. (2010) meant that culture influenced the way knowledge was created and interpreted, which is in line with Vygotsky sociocultural theory (Doherty, 2013). Hence, understanding the local means of generating and interpreting knowledge, in this case, use of the indigenous language, was fundamental in achieving learning with/through ICTs at ECD level.

Conclusion

It was found that there were two types of ICT use prevalent in ECD classrooms, that is; ICT use supporting basic ICT operational skills (learning about ICTs) and ICT use supporting contents and individual learning needs (learning with and through ICTs). The initial mode of ICT use occurred more frequently than the latter at GCM schools. These findings are consistent with analysis of schools and teacher educational curriculum in Zimbabwe (Ministry of Higher and Tertiary Education, 2018). It was observed that ICTs are taught at ECD level as teacher-directed activity, it results in learners acquiring basic ICT operational competences, which can be equated to ‘learning about ICTs’. Basically, teachers engage ICTs as an isolated activity to develop basic technical skills more than to support and enhance learning through ‘playful’ learning experiences (Kalas, 2010).

The use of ICT to support contents and individual learning needs is commensurate with ‘learning with/through ICTs’. This was common practice at trust schools. Adequacy of, easy access to ICTs and familiar language on

ICT software packages enabled provision of interactive learning experiences, to nurture the 'new millennial learners' to adapt to the ever-changing technologies

Recommendations for Further Research

This study was limited in that only perceptions and experiences of ECD teachers were considered which did not include those of children. Further research can involve children and directly measure teachers' ICT competences.

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