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An extent to which ICTs are being used in the teaching and learning of mathematics in selected secondary schools of central province, Zambia

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Abstract
This article is an extract of one of the objectives from the PHD study entitled "A Problem-Solving ICT education approach and its implications on the teaching and learning of Mathematics in selected secondary schools of Central Province, Zambia". The background of this study is anchored on the fact that the implementation and integration of Information and Communication Technologies (ICTs) especially in the learning and teaching of Mathematics has remained one of the huge challenges facing most African countries including Zambia. This scenario has been compounded by a number of factors at play. Some of which include but not limited to the following: lack of technological equipments, uncoordinated implementation of the ICT policy, high cost of acquiring and maintaining technology, lack of technological know-how and problems that borders on pupils', teachers', parents' and policy markers' attitudes (MoE, 2012). [14] This article therefore argues that an appraisal on the design, implementation and integration of ICTs especially in the teaching and learning of Mathematics in secondary schools is not only relevant but also an issue that should be treated with the sense of urgency (Demana, 2000;[2] Dick, *et al*. 2011[3]).
In light of the above challenges, this study sought to establish the extent to which ICTs are being integrated and used in the Zambian education system a case of selected secondary schools of Central Province. In achieving this task, the study employed a descriptive research design which adopted both qualitative and quantitative paradigms. Data was collected through semi-structured questionnaires for pupils and interview guide for teachers. The sample comprised of 150 participants. A simple random and purposive sampling procedure was used to select pupils and teachers respectively. Thematic analysis was employed to analyse qualitative data while the Statistical Package for Social Science (SPSS) and excel was used to analyse quantitative data.
The study found that despite teachers' and pupils' having a strong desire to use ICTs, the application and use of ICTs was to a larger extent not integrated in the teaching and learning of Mathematics in Zambian secondary schools. For those pupils and teachers who did use ICTs in the learning and teaching process, they did so due to their own curiosity. It further emerged from the study that the calculator was the commonest technology which was being used by both teachers and pupils in the process of teaching and learning of Mathematics. Furthermore, the study revealed that both teachers and pupils faced similar challenges of which the biggest was lack of ICT facilities and infrastructure that made the use of ICTs in most Zambian secondary schools a fallacy at the time the study was being conducted. Based on the findings, the following recommendations emerged among others: 1. Policy makers and curriculum specialist should develop the curriculum that supports the use of ICTs in the teaching and learning of Mathematics. 2. School management in collaboration with government, Parent Teacher Association (PTA) and the private sector should acquire more ICT equipments such as overhead projectors, making internet easily accessible, television, radios, tablets and CDs with pre-loaded educational materials, computers and other various ICT based application software that would promote problem solving ICT education in the Zambian secondary schools. 3. Government through the Ministry of Higher Education should develop ICT training programmes in all the colleges and Universities so that all our graduates would acquire strong ICT skills.

Keywords: Problem Solving ICT education, Teaching and Learning, Mathematics.

1. Introduction

1.1 Background of the study

The perception of many people towards Mathematics is that it is a very difficult subject. The study conducted by Sidhu (2013: 13) [22] reveals "...mathematics is an exceptionally difficult subject, i.e., its study requires special ability and intelligence, therefore everybody should not be burdened with the study of this subject." Contrary to such negative perceptions, mathematics plays a critical role in the technological advancement and development of any nation including Zambia. Moreover, teaching and learning methods are changing in modern society. For instance, internet is more and more being used as a platform for educational material delivery and pupils' academic administration. In fact the use of internet makes the geographical distances no longer a burrier in modern learning and teaching processes. In other words, at all levels of education, teaching and learning of any subject area including Mathematics is made easier by demonstrations and the use of internet and other ICT facilities. This in turn, helps pupils not only to be part of the teaching and learning process but also to be in control and at the centre of the whole learning process. Slavin (2006) [24] observes that the use of ICTs implies that much of the role played by the teacher in the traditional style of teaching is left out to the learners thereby enabling pupils construct knowledge in their own minds. The teacher in this

regard does act as a facilitator by giving pupils opportunities to discover or apply ideas themselves.

Additionally, even though it can be viewed from a psychological point of view, Mathematics in its strict sense is a curious subject which should be approached creatively. Otherwise, most pupils would get discouraged just at the first face of the subject. Skemp (1971) [23] assets that there are those pupils who can do mathematics and there are those who cannot, or think they cannot, or who block at the first drop of a symbol. Currently, the status quo of Mathematics education in most Zambian schools presents a similar picture and requires creative and superior minds to learn and appreciate the subject. It is generally felt that there is a definite problem to the teaching and learning of mathematics as witnessed by continued trend of learners underachieving in mathematics at almost all levels of education (MoGE, 2015) [13]. In view of this scenario, there has been a universal recognition of the role ICTs would play to improve not only pupils' academic performance but also effectively and efficiently delivery the Zambian education system to the general citizenry. After all, due to its critical role in national development, mathematics should be taught to everyone at least up to secondary school level. The implication is that a great deal of effort should be employed in the way mathematics is taught and the adoption of ICTs seems to be the right course of direction to be embraced by government and all other stake holders in the education sector.

Therefore, the importance of ICTs in the teaching and learning of Mathematics cannot be overlooked. Roschelle (2000: 4) [19] argues "the benefits of integrating technology in the teaching and learning of mathematics cannot be undermined...technology helps the teacher of mathematics to teach better mathematics and to teach mathematics better." This statement clearly brings to light two important aspects of teaching mathematics; the curriculum and the methodology. In this respect, Moongwa (2014: 67) [15] indicates "mathematics curriculum especially in Zambia has no provision of technology use in its implementation." This state of affairs appears to be a draw back on the part of the teachers as they struggle to cover the syllabi. However, with the help of ICTs, a teacher can concentrate on teaching advanced topics and basic calculations be left for pupils to do on their own, of course with the help of ICT based devices. For example, teachers can use ICTs to reduce on memorising formulas and performing routine calculations but instead they can do more of developing ideas, exploring consequences, justifying solutions and transforming abstract thinking into solving real-life situations and problems thereby contributing positively to the development of the country. Kaput (1992: 24) [8] writes "technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning." Waits and Demana (2000: 76) [28] seems to agree with Kaput and others as they argue "...adoption of technology by teachers requires professional development that focuses on both conceptual and pedagogical issues, ongoing support in terms of intensive start-up assistance and regular follow-up activities and a desire to change from within the profession." Further,

studies of teachers' implementation of educational ICTs revealed that at least three to five years are needed for teachers to become competent and confident in teaching using ICTs. [28] Furthermore, Kerr (1996: 24) [9] made similar conclusions that integrating ICTs into classroom practice requires "a radical shift in both teaching style and the teacher's vision of what life is all about. This new vision has been one that changes the teacher's role in basic ways, reducing the importance of 'chalk and talk', increasing the need for sensitivity to individual students' problems and achievements, shifting how classrooms are laid out, how evaluation is conducted, how teachers relate to their colleagues, and a hundred other particulars of daily life in schools."

Dick and Hollebrands (2011) [3] equally observed that the integration and use of ICTs encourages and stimulates pupils' ability to reason and make sense in mathematics. It is clear from the studies done so far that integrating ICTs in the teaching and learning of Mathematics yield positive results not only for the pupils' good academic performance but also act as a catalyst of national, regional and global development. Despite vivid and empirical evidence of the positive role ICTs play in the teaching and learning of Mathematics, many questions still arise as regards the adoption of ICTs in the Zambian education system. For instance, what types of technologies are being promoted in Zambian secondary schools? To what extent are the ICTs being used in our Zambian schools? Have the quality and the type of ICT education being taken into consideration before making the ICTs compulsory in our schools? Do we have trained ICT human resource or teachers? What about the ICT policy, is it comprehensive and inclusive? Does the ICT policy for education clearly spell out and budget for the design, implementation and execution of the ICTs in the Zambian education system? These and many more questions merit conducting a study of this nature.

1.2 Statement of the problem

There has been a growing body of research in recent decades that is putting much emphasis on the importance of ICTs in the teaching and learning process especially in the field of mathematics, science and technology. UNESCO (2013)[27] observes that integrating ICTs in the learning and teaching process is beneficial both to learners and teachers as it lessens teacher centred curriculum and promotes self-directed learner centred approach thereby enabling pupils easily comprehend and understand mathematical problems. Despite the foreseeable benefits of ICTs in the teaching and learning process, the situation in Zambian secondary schools is however different from what is expected. While ICTs embraces different and numerous technologies that should be used to deliver quality education to learners, it was found that in most African countries' schools including Zambia, the calculator was the mostly used technology in the teaching and learning of mathematics (UN, 2012) [26]. Further, the integration and use of ICTs in the Zambian education system has been compounded by a number of challenges ranging from lack of up-to-date IT learning materials to lack of technological equipment (MoE, 2012) [14]. In light of these challenges, it remains unknown the extent to which ICTs are being used and integrated in the teaching and learning of mathematics in Zambian secondary schools, hence this study.

1.3 Significance of the study

Undertaking this study was significant in that the knowledge generated would help both teachers and pupils to know the extent to which they use ICTs in the teaching and learning of Mathematics. The findings would be made available to government and policy makers which would in turn act as basis for policy and curriculum formulation, implementation and

execution with ICTs being at the centre of the Zambian education system. The outcome of the study would also help government through the Ministry of General Education (MoGE) to take stock of what type of technologies are being used in the Zambian schools hence enabling the said institutions make informed planning, procurement and distribution decisions. Further, the findings would help stimulate debate which may lead other researchers to carry out more studies on the extent to which Zambian secondary schools implement ICTs in the teaching and learning of Mathematics.

1.4 Study site

The study was conducted in selected secondary schools of Central province. Three schools selected were adequate as the descriptive research design used in the study required a relatively larger sample. These sites in Central Province were chosen because they had been teaching computer science as a subject and they use ICTs in one way or another.

1.5 Literature Review

Globally and according to the European Commission (2013) [4], 50% of the students are in schools with formalised policies on the use of ICTs in education which were based on written statement. Sadly, out of the fifty percent, only 20% of the students learn in schools where policies covering the use of ICTs in the education system have been adopted. It is clear from such statistics that the integration and use of ICTs in education are still relatively globally and Africa being the worst hit due to policies that are not clear and lack realistic implementation strategies and budgets (UNESCO, 2013) [27]. At continental level (i.e. Africa), the process of adopting ICTs in the education sector is still in transition phase (Shafika, 2007) [20]. Although there are some success stories being recorded especially from countries like Kenya and South Africa, the general picture is that integration of ICTs in the education system in most African nations remains on paper and lacks tangible policy and budgetary support from respective governments. In short, the ICTs penetration levels in most African countries' education sector remain very low (Trucano, West, Shafika, Farrell, Hamdy, Fall, Hare, Tchinda, Mangesi, Tutu and Ngombo, 2007) [25]. For instance a study by Maris and Nicolaou (2004) [11] revealed that the use of ICTs was relatively appreciated among pupils from the International Council of Associations in Science Education Cyprus. In this study, when students were asked to indicate whether they used ICTs in the learning of mathematics, only 56% of the students answered positively. This was found to be a very low percent when compared to those who use ICTs for personal purpose which stood at 88%. Among the pupils who used technology for mathematics 98% use calculators, 76% use computers and 71% use both. Despite a high percentage of students who used computers in their mathematics course, only 18% use mathematics software [11].

According to the National ICT policy of Tanzania (2003) [5] indicates that ICT encompasses telecommunications services, computers and associated peripherals, internet services, e-mail, fax, broadcasting, televisions and other forms of media. It was observed that one of the objectives of the National ICT Policy of Tanzania is to use ICTs in order to improve the quality of delivery of education and training in all mode of education including distance learning. It should also be noted that the application of ICTs in the teaching and learning processes vary from country to country based on their technological advancement and financial, human and technical resources made available to the sector. For instance, the study by Kalinga (2008: 78) [7] in Tanzania focused on the "development of interactive e-learning management systems (e-Lms) for Tanzanian secondary schools in which ten areas from Tanzania regions and districts were chosen to participate in the study. The survey indicates that although some schools managed to acquire computers from their own school funds, donors and government, the majority however did not have internet services due to high costs of maintain information technology infrastructure among other factors.

Zambia like other African countries has an ICT policy and also the ICT policy for education. The main aim of the ICT policy for education was to provide an enabling policy environment that is expected to promote access and use of ICTs in all the sectors of the Zambia's education system. The national ICT policy synchronised other important national policies such as the Fifth National Development Plan (FNDP) and the Vision 2030 which all recognises the role of ICTs as the main vehicle for realising social, political and economic development (IICD, 2014) [6]. The Vision 2030 further singled out ICTs as the major contributor towards attaining an innovative and lifelong education and training in Zambia by 2030. One of the guiding principles of the policy is an integrated approach that must be adopted that would integrate all aspects of the value chain in the education process. Despite such pieces of legislation being in place, the integration of ICTs in the Zambian education system remains very low (Shafika, 2007). [20] Further, despite such efforts put in place by government, very little tangible results have been achieved in terms of ICT integration due to several factors as alluded above. This has also affected the rate at which teachers and pupils apply ICTs in the learning and teaching processes especially in mathematics and sciences.

As regards to using ICTs during the learning time by either pupils or teachers, the pupils identified calculator, mathematics software and projector as the main types of ICT facilities employed. Additionally, the respondents were further asked to indicate how they learnt to use a computer, the study revealed that the majority of the pupils had the ability to learn computers on their own. On the other hand, the teachers used computers as a secondary source of information to help them plan mathematics lessons. The study furthermore brought to light that 89% and 83% of the respondents indicated that they used computers and calculators for class work only respectively. It should be noted that the study by Maris and Nicolaou (2004) [11] was conducted in a University environment which could have influenced the use of ICTs due to high levels of maturity and financial independence of the respondents.

The recent study done in Zambia by Mtanga, Imasiku, Mulauzi and Wamundila (2012:8-9) [16] on the use of ICTs in the education system from selected high schools within Lusaka district revealed the following:

- High schools in Zambia are using ICTs in the teaching and learning activities and that computer is the ICT facility mostly used in all the schools.
- Usage of ICTs in very low as very few teachers and pupils were utilizing such facilities.
- Use of ICTs for administrative purposes is limited to report writing and correspondence as there is no evidence of any other usage such as financial and human resource management.

- All schools have some formal ICT training programme, though in some cases these are not regularly conducted and evidently, they are poorly advertised.
- ICT skills are low among both teachers and pupils.
- Computers available are inadequate and time allocated for their use is insufficient.
- Pupils appear to be more appreciative of the benefits of integrating ICTs in academic activities than the teachers.

While the findings of the study by Mtanga and others are appreciated, however a number of concerns can be raised: In the first place, the study was conducted in urban secondary schools only. Therefore, to claim that all secondary schools in Zambia use ICTs in the teaching and learning could be challenged in that some secondary schools especially in rural and remote areas do not even have a single ICT facility. The other gap is that the study dealt with ICT use in education generally but this study specifically looked at integration of ICTs in the teaching and learning of mathematics. These and many other gaps such as those to do with selection of research design; sample population and choice of research instruments have been addressed in this study.

Furthermore, taking a snapshot on recent studies conducted on the subject under review, one of the most important questions being asked is what causes an individual or organisation to adopt ICTs? It can be argued that whether the demand to use ICTs is influenced by internal or external factors, the need for ICT integration and use in the teaching and learning of mathematics is becoming a common phenomenon in most societies due to the prominence of e-learning environment (Khalid, 2005). [10] In their study, NCTM (2014: 15) [17] made related arguments, "technology has been credited for being useful in reducing the effort devoted to tedious computations and increase students' focus and comprehension of mathematical problems." The implication here is that if used effectively and efficiently, ICTs can enhance pupils' learning process and academic outcome. Zambian secondary schools are not very different from those of other countries like Tanzania. Despite Zambia having an ICT policy and ICT policy for education and other pieces of legislations, to date there is no single school in Zambia that has equipped each classroom with technology. Moreover, Zambia had its first ICT practical examinations for grade nines in 2015 which was characterised by uncoordinated examination administration because of lack of computers and electricity in most schools especially from rural areas. This further authenticates the need for the study amidst government policy pronouncements of making ICTs compulsory in all Zambian schools. It can therefore still be argued that the extent to which ICTs in the Zambian secondary schools are being used and integrated remain unknown, hence the gap this study wanted to address.

2. Methodology

The study undertook triangulated methodology approach where both qualitative and quantitative methods were used to collect data.

2.1 Research Design

The descriptive survey research design was used in this study. The design was suitable because the study sought pupils 'and teachers' opinions and experiences towards the use and integration of ICTs in the teaching and learning of mathematics in secondary schools. Osuala (2001) [18] argues that the use of descriptive survey design tends to reduce errors and biasness. Therefore, the descriptive design was chosen in order to increase the reliability, validity and generalisations of the findings.

2.2 Population

The study comprised of pupils and mathematics teachers from selected secondary schools in central province.

2.3 Sample Size

The total sample of 150 participants was considered for the study. This sample consisted of 130 pupils and 20 mathematics teachers. Table 1 below provides demographic characteristics of the participants drawn from the sample.

Table 1: Demographic Characteristics of participants

Category	Male	Female	Total	Percentage
Pupils	65	65	130	86.7%
Mathematics Teachers	18	2	20	13.3%
Total	83	67	150	100%

2.4 Sampling Procedure

Simple random sampling was used to select pupils in order to accord each pupil equal chance of being chosen to participate in the study. The teachers of mathematics on the other hand were purposively selected because they were useful informants as they teach mathematics in the sampled secondary schools.

2.5 Instruments for data collection

The study used two types of instruments namely questionnaires and semi-structured interviews. The questionnaires were used to collect data from pupils who were the majority. Further, questionnaires were used because the sample composed of secondary school pupils who were literate. Furthermore, questionnaires were used as they were user friendly, save time and suitable when dealing with quantitative data. However, the inadequacies of using questionnaires were supplemented by employing interview schedules. The interviews unlike questionnaires helped in collecting in-depth and comprehensive data from teachers of mathematics.

2.6 Data Analysis

Quantitative data was analysed using excel and Statistical Package for Social Sciences (SPSS) which helped in generating frequency tables and other descriptive statistics for easy interpretation and analysis. On the other hand, qualitative data obtained from interviews was analysed using themes and content analysis. Emerging themes were critically and objectively described, analysed and interpreted. Further, ethical issues were also taken into consideration by obtaining participants' consent and permission from relevant school head teachers. In addition, the respondents' identities were kept anonymous as a way of enhancing confidentiality and privacy.

3. Findings and Discussion

In establish the extent to which ICTs were being used in the teaching and learning of mathematics in Zambian secondary schools, pupils were asked whether they used ICTs in the learning of the mathematics. The responses are shown in Table 2 below:

Table 2: Pupils Views on the extent to which they use ICTs in the Learning of Mathematics

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I use ICTs in learning mathematics	43	66	10	8	3
	33.1%	50.8%	7.8%	6.2%	2.1%
My teacher uses ICTs in teaching mathematics	9	40	27	27	27
	6.8%	30.8%	20.8%	20.8%	20.8%
I access and use internet facilities at school	12	23	10	22	63
	9.2%	17.7%	7.8%	16.9%	48.4%
I use computers in learning mathematics	9	16	44	30	31
	6.8%	12.2%	33.8%	23.1%	24.1%

Source: Field Data, 2015

It is clear from the findings indicated in table 2 that the majority of the pupils 109(83.9%) used ICTs in one way or another in learning mathematics as compared to those who disagreed and those who remained neutral with representation of 11 (8.3%) and 10 (7.9%) respectively. Asked as to whether teachers use ICTs in the teaching of mathematics, 54 (41.6%) disagreed, 49(37.6%) agreed while 27(20.8%) neither agreed nor disagreed. As regards to having access and use of internet facilities while at school, the majority 85(65.3%) disagreed having access and using internet, 35(26.9%) agreed while the minority 10 (7.8%) remained neutral. On the other hand the majority 61(47.1%) confessed that they did not use computers in learning mathematics, this was followed by those who remained neutral 44 (33.8%) and a small number 9 (6.8%) who agreed having used computers during mathematics lessons.

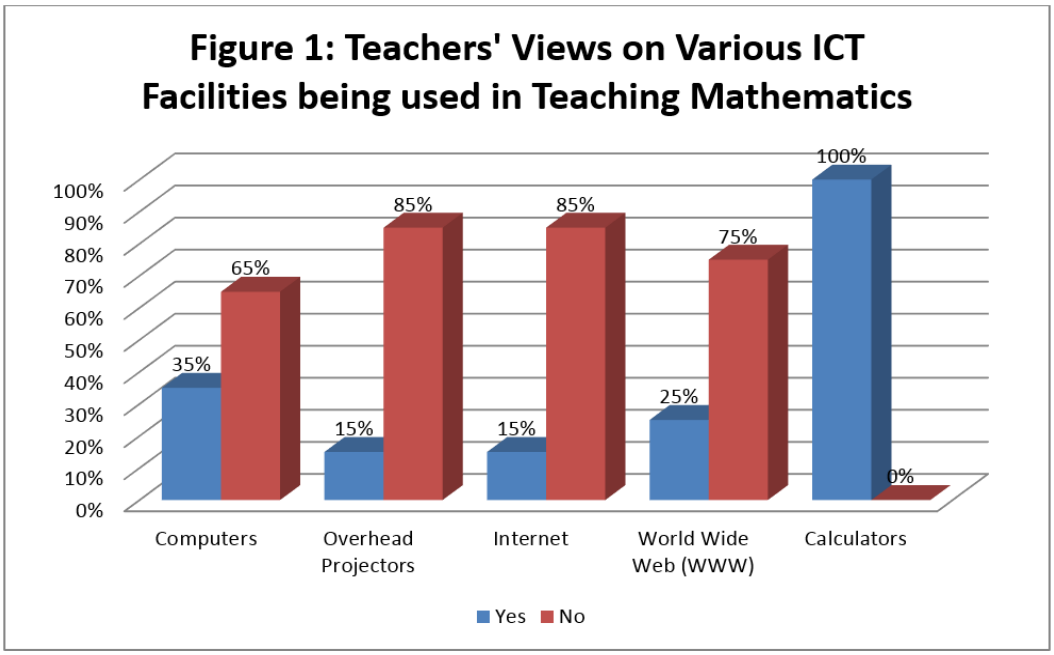
Table 3: Teachers views on the extent to which they use ICTs in the teaching of mathematics

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I use ICTs in the teaching of mathematics	0	10	3	5	2
	0%	50%	15%	25%	10%
Using ICTs in teaching mathematics attracts pupils' attention in class	10	8	2	0	0
	50%	40%	10%	0%	0%
I use different types of ICT tools to teach mathematics	3	5	7	5	0
	15%	25%	35%	25%	0%

Source: Field Data, 2015

The data collected and presented in table 3 indicates that 10 (50%) of the total number of teachers who participated in the study use ICTs in teaching mathematics, 7(35%) disagreed while 3 (15%) remained mute. Asked as to whether using ICTs in the teaching of mathematics encouraged pupils to pay attention to the subject, the majority 18(90%) firmly agreed while 2 (10%) were undecided. The findings also show that integrating ICTs in the teaching process act a good motivator to pupils as none of the teachers who took part in the study disagreed. As regard to whether teachers employ different ICT tools in the process of teaching mathematics, 8 (40%) agreed, 7 (35%) remained neutral while 5 (25%) disagreed.

In trying to probe further the extent to which teachers integrate ICTs in the teaching of mathematics, this study furthermore asked teachers to indicate various ICT platforms and facilities commonly used and the results are presented in figure 1 below:



Source: Field Data, 2015

It is evident from research findings presented in figure 1 that calculators were the most preferred 20(100%) type of technology being used in Zambian secondary schools. The use of computers 7(35%) was the second most popular mode of teaching mathematics while the use of WWW ranked third 5 (25%). On the fourth position, there was a tie between using the internet 3 (15%) and the utilisation of overhead projectors 3(15%).

The outcome of this study seems to suggest that majority of pupils who participated in the research used ICTs in the process of learning mathematics. While this was a good indication of the growing trend of using ICTs in the learning process, the truth of the matter is that these pupils employed technology due to their own curiosity and it was done informally. It was established from the study that most of those pupils who showed interest in using ICTs in learning mathematics came from rich families where internet and other ICT facilities were easily available and accessed. As regard to other pupils especially those coming from poor and rural areas, it was difficult to appreciate the use of ICTs. As argued by Maris and Nicolaou (2004) [11] while the majority of the pupils had strong desire to use ICTs in the learning of mathematics, such enthusiasm was retarded and constraint by a number of challenges such as lack of computers, lack of internet facilities and lack of technological infrastructure in schools. The Ministry of General Education (MoGE, 2015) [13] further observed that although pupils would be willing to learn using ICTs, but their morale was dampened due to lack of trained ICT teachers, non-availability of electricity especially in rural secondary schools, lack of internet facilities and other digital resources to mention but a few. Additionally, pupils indicated that majority of teachers did not use ICTs in the teaching of mathematics. Other than teacher's individual perceptions and attitudes towards ICT integration in the teaching process, the above highlighted problems by MoGE (2015) [13] also acted as major hindrances to fruitful integration of ICTs in most Zambian secondary schools.

On the other hand, although the pupils who participated in the study showed a greater interest in using ICTs in the learning of mathematics, very few teachers felt the integration of ICTs in the teaching and learning process could bring benefits to the pupils. Moreover some teachers especially some from rural areas were not even aware of the ways in which ICTs could be applied in the teaching and learning of mathematics. This could be attributed to the low ICT competence levels among teachers. For such, they may require substantial help in using ITCs. This is confirmation enough that it would be very difficult for teachers with low ICT competence levels to integrate ICTs in their teaching process later on during mathematics lessons. Nevertheless, there are a small percentage of teachers who commonly use different types of ICT facilities as indicated in figure 1, who value the contribution of ICTs in the teaching and learning of mathematics. As observed by Mtanga *et al.* (2012:8) [16] "those teachers who value the contribution of ICTs to education expressed views that everyone needs to access and should be able to use ICTs in their work for tasks such as preparation of tests and reports. Another reason they advocated for use of ICT is that they can facilitate easy research and preparation of teaching materials."

Furthermore, the uncoordinated implementation of ICT policy for education further compounded the much needed progress in as far as ICT integration in the Zambian education system was concerned (MOCT, 2006) [12]. While the Zambian government has put some measures such as the establishment of Zambia Information Communication and Technology Authority (ZICTA) to spearhead and mobilise resources for the advancement of ICTs in all sectors including education, the implementation aspect is not fully funded by government (Sichone, 2011) [21]. Instead, the ICT sector is still heavily dependent on donor support (UNESCO, 2013) [27]. Zambia has very good pieces of legislation on ICTs but these policies are mainly just on paper as real implementation and tangible results still remains a pipe dream as little political will is shown to mobilise resources for the actualisation of this important endeavour (IICD, 2014). [6] A very good example is the recent grade nine ICT practical examinations which were characterised by lack of coordination, computers and other ICT facilities. Pupils were made to cover long distance to access such facilities thereby forcing some rural schools to conduct examinations up to midnight (Daily Nation, 2015) [1]. This is being reactive and as the result our pupils and teachers may not only get discouraged to actively use ICTs in the learning and teaching of mathematics but also receive a substandard ICT education.

4 Conclusions and Recommendations

Based on the findings of this study which sought to establish the extent to which ICTs are being used in the teaching and learning of mathematics, it has emerged that both teachers and pupils were willing to use ICTs in their mathematics lessons. The determination to integrate ICTs in the teaching and learning of mathematics were however constrained by lack of internet services, lack of electricity, lack of computers and lack of IT based infrastructure and the curriculum that did not support the integration of ICTs in the teaching and learning of mathematics. For those who use the ICTs, it is either they attended their education from schools along the line of rail where computer science is offered as a subject or they have basic IT resources or did so due to their own curiosity. Otherwise most of the secondary schools especially from rural areas remain neglected making the integration of ICTs in the Zambian education system a fallacy. The following recommendations therefore emerged from this study: 1. Secondary school management boards with the support of government, private sector and Parent Teacher Association (PTA) to invest more in technological equipment especially in rural areas. 2. Government through Ministry of General Education, the Curriculum Development Centre and strategic policy makers should formulate policies and curriculum that will be supported by ICTs especially during the implementation stage. 3. All the teacher training institutions from early childhood to the University level should integrate ICTs in the training programmes so that all the grandaunts should graduate not only with ICT skills but also acquire problem solving ICT education.

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