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Pupils' and teachers' perception toward the use of Information and Communication Technology (ICT) 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 a PHD study titled "A Problem-Solving ICT education approach and its implications on the teaching and learning mathematics in selected secondary schools of Central Province, Zambia." In this 21st century, learning institutions globally have realised the significant role information and communication technologies (ICTs) play in the delivery of quality education to majority citizens. The Zambian education system like many countries have jumped onto the wagon of implementing and adopting ICTs in the education curriculum later on in all public schools. Although some minimal successes have being recorded especially in schools situated in urban areas, the effective, efficient and full implementation still faces huge battles such as deficits in electricity supply, lack of ICT tools and incapacitation in adapting to ever improving and newly developed technologies to mention but a few. Other than the above highlighted challenges, there has been another silent problem hindering the full implementation of ICTs in Zambian schools. This latent challenge is associated with pupils' and teachers' perceptions towards the use of ICTs in the teaching and learning Mathematics. Therefore, this study sought to establish pupils' and teachers' perceptions towards integrating ICTs in schools.
The study used a descriptive research design which employed qualitative and quantitative research approaches. Questionnaires and interview guides were used to collect data from pupils and teachers respectively. A sample of 150 participants was employed in this study. Further, in order to accord equal chance to every pupil to participate in the study, a stratified random sampling procedure was used to select pupils while teachers were purposively chosen. The statistical package for social sciences (SPSS) and excel were used to analyse quantitative data while thematic analysis was employed to analyse qualitative data. The findings from the study revealed that both pupils and teachers showed a positive perception towards the use of ICTs in the learning and teaching of mathematics. Despite both teachers and pupils holding a positive perception, pupils were more appreciative of the benefits of integrating ICTs in their mathematics lessons as compared to teachers. However, the use of ICTs in the learning and teaching of mathematics were hampered by a considerable number of challenges such as lack of ICT facilities, unsupportive curriculum, high cost of procuring and maintaining ICT tools and lack of internet connectivity to mention but a few.
Based on the findings of the study, three major recommendations emerged: Firstly, government through the Ministry of General Education (MoGE) should provide adequate teacher training in ICT skills and ensure that both pupils and teachers have access to computers and internet facilities. Secondly, the Ministry of General Education in collaboration with school authorities, Parent-Teacher Associations (PTA) and the private sector should promote other ICT facilities such as television, radio, CDs, DVDs, overhead projectors and videos rather than just concentrating on computers and internet resources which are not only expensive to acquire and maintain but also unavailable especially in rural school. Thirdly, ICT being a practical subject, schools should allocate adequate time for both learning theory and more importantly conducting ICTs practical.

Keywords: ICT education, Pupils' and Teachers' Perceptions of ICTs, Zambian schools

1. Introduction
This section presents the background of the study, statement of the problem, significance of the study, theoretical framework and study site.

1.1 Background of the study
According to the Zambia Demographics Profile (2014), [39] Zambia has an estimated population of about 14,638,505. This population figure takes into account the effects of excess mortality due to HIV/AIDS which can result in lower life expectancy, higher infant mortality, higher death rates, lower population growth rates and changes in the distribution of population by age and sex. This population of over 14 million, the age structure is such that 46.2% are aged 14 years and below, 20% aged between 15 and 24 years and 28.5% caters for those aged 25 to 54 years (CSO, 2014). [6] It is clear from the statistics above that majority of the Zambian population are youths who are either in primary, secondary or tertiary levels of their education.
The Central Statistical Office (2014) [6] adds that Zambian total dependency ratio stands at 96.4% out of which the youth dependency ratio is estimated at 91.3%. Further, the Zambian life expectancy at birth stood at 51.83 years of which 50.24 years are the life expectancy for males while 53.48 years for females. Furthermore, the HIV/AIDS adult prevalence rate stands at 12.7%, about 1,106,400 Zambians are living with

HIV/AIDS while 30,300 had died of HIV/AIDS by 2012 (CIA, 2014).[4] Zambia spends about 1.3% and 6.1% of its Gross Domestic Product (GDP) on education and health respectively. The nation is equally compounded with other vices such as high poverty levels where 60% of the total population live below the poverty line or on a less than a dollar a day (CSO, 2014), [6] high unemployment rate of 23.4% for youths between 15 and 24 years (CIA, 2014)[4] and early marriages (World Vision, 2014)[38] and (Wina, 2014).[37] These statistics do not only demonstrate the tragedy of the Zambian populace but also they are distressing realities that requires realistic, practical and proactive solutions.

In order to address some of the vices highlighted above, the Zambian government through the Ministry of General Education (MoGE) and other key partners have identified education as one of the effective and sustainable tool that can be employed to combat such problems most citizens encounter especially the vulnerable and less privileged groups. A study by UNESCO (2013)[33] reveals that empowering the youths with quality education is one of the sustainable measures to deal with high poverty levels, early child marriages and HIV/AIDS scourge to mention but a few. Therefore, in order to reach out to as many youths as possible and provide quality education, the Zambian government just like many other nations globally have embraced the use and integration of Information and Communication Technology (ICT) in the delivery of education. As already alluded, the use of ICTs is becoming inevitable in educational institutions in the world of which Zambia as a country is not an exceptional. Moreover, ICTs are considered to be one of the answers to improving the general academic knowledge of pupils, learning outcomes and that call for change in the delivery of education. In this regard, Voogt and Knezek (2008) [35] presented data to support their argument that ICTs facilitates the move from the 'traditional pedagogy' to the modern discovery methodologies which are centred on the learner and based on the learner's activity. In agreement to the above, Anna (2003),[2] who is the former United Nations Secretary General confirms that, if harnessed properly, ICTs have the potential to improve all aspects of people's social, economic and cultural life. In other words, ICTs can serve as an engine for development in this twenty-first century.

Stressing the importance and need for integrating ICTs in the education system, the Zambian government developed and adopted the National ICT policy in 2007 and further drafted an ICT policy for education (UNESCO, 2013).[33] Further, the Ministry of General Education (MoGE) ICT activities in education have centred on the development of curriculum materials, e-learning, classroom teaching and learning, delivery of education through radio and television, development of teacher capacities and digitalization of the distance learning materials, all of which are focused on ICT integration in education as a way of improving quality and increase access. Furthermore, the Zambian government recently implemented the first ever ICT grade nine practical examinations. This shows great commitment on the part of government by adopting ICTs in the learning and teaching process in our schools across the country. Although the first ICT examinations were characterised by numerous challenges such as lack of computers and non-availability of electricity especially in rural areas, the move however by government through the Ministry of General Education speaks volume on how urgent the issue of integrating ICTs in the Zambian education has been prioritised. Despite numerous benefits that come along the use and integrating ICTs in the education sector (such as producing a self-directed learner, increasing motivation for learning and teaching, stimulating activity and collaboration), pupils' and teachers' perceptions towards ICTs has received limited attention in terms of research studies. Moreover, pupils and teachers are key stake holders in the learning and teaching processes of which, if ignored could impact negatively on the implementation of ICTs in the Zambian schools. In view of this, there was urgent need to conduct a study whose purpose was to establish pupils' and teachers' perceptions towards the use of ICTs in the education sector, hence this inquiry.

1.2 Statement of the problem

There has been a growing body of research that has empirically claimed and proved the significant role ICTs play not only in the development of the nation but also in the provision of quality, effective and efficient education system (UNESCO, 2013).[33] The benefits of integrating ICTs in the education sector are many such as the promotion of leaner-centeredness activities as opposed to teacher dominated curriculum, attainment of collaborative learning among pupils coupled with the enhancement of critical and logical thinking among others. Zambian schools have come on board in the use and adoption of ICTs in the acquisition of pedagogical skills. The implementation of ICTs in the Zambian public schools has come with challenges such as lack of trained ICT teachers, inadequate computers and lack of supply of electricity especially in rural areas (MoGE, 2015). [17] Government and other stake holders have been tirelessly working on addressing some of these challenges. One of the latent challenge that has not received adequate attention such that if not addressed urgently would negatively impact the implementation of ICTs in the Zambian education sector is pupils' and teachers' perceptions towards the use of technology in the teaching and learning process especially in subjects like mathematics and sciences. This study therefore, sought to establish perceptions that pupils and teachers have towards the use of ICTs in the education system later on in teaching and learning of mathematics.

1.3 Significance of the study

It can be argued that investing heavily in procuring computers and other ICT facilities would remain futile if the people who are suppose to use the said ICT tools are ignored. What is the point of having huge airbuses without people? Computers and ICT facilities are useless in themselves if people who are suppose to use them are absent or do not appreciate such technologies. In light of this, the study was significant in that the knowledge generated would help the pupils, teachers, parents, government through Ministry of General Education (MoGE) and other partners in the education sectors to know how ICTs are being perceived. Further, the findings of this study would go along way stimulating debate among scholars thereby provoking other would be interested researchers conduct similar studies in the area of ICT use in the Zambian education sector hence perfecting the professional practice of integrating ICTs in the acquisition of pedagogical skills among our pupils. Moreover, pupils and teachers are a key component

in the delivery of technological innovation in the classroom, and findings from this study would give an insight into perceptions of pupils and teachers towards the use of ICTs in the teaching and learning of Mathematics and education in general. Such information would be helpful to policy makers and curriculum planners in their review of ICT policies to help improve the quality of Mathematics education and later on transform Zambia into a knowledge-based economy. Moreover, the outcome of the study would equally add to the much required scholarly literature on the adoption of ICTs in Zambian education system and schools.

1.4 Theoretical Framework

The study was guided by Hebb's theory of perception. According to Omari (2011) [24] a theory is defined as thought processes and thinking system or schemes for explaining and predicting a set of happening or natural phenomenon such as behavioural changes. It may be argued based on the definition above that theories have a great inspiration powers to human thought which should be promoted and these include but not limited to hypothetical, imagination, creativity and probabilistic thinking. Theoretical framework according to Kombo and Tromp (2006: 56) [12] therefore is defined as "...a collection of interrelated ideas based on theories. It is a reasoned set of prepositions, which are derived from and supported by data or evidence." The importance of theory in any research cannot be overemphasised as Kwame Nkrumah of Ghana correctly observed that '*theory without practice is hollow; and practice without theory is blind*'. It therefore follows that *theory illuminates practice and practice illuminates theory* (Omari, 2011).[25] This to a larger extent justifies the decision to adopt Hebb's theory to guide this study that sought to establish pupils' and teachers' perceptions toward ICT use in education.

Donald Hebb was a Canadian Psychologist who did a lot of work on the understanding of perception. His work was mainly reconciliation between the extremist positions taken by behaviourists and Gestalt theorists as regards to formation of perception in people. Kuppuswamy (2012: 168) [13] writes:

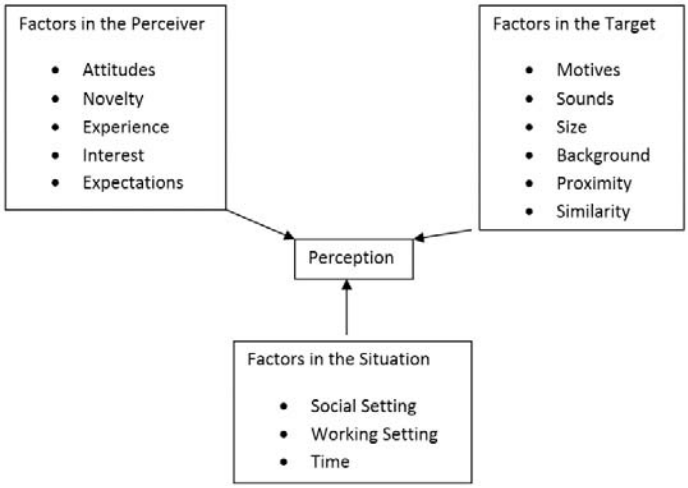
Behaviourists have been placing importance on learning while Gestalt psychologists have left very little to be contributed by learning...Hebb came to a conclusion that although certain characteristics are innately determined there are however certain other characteristics that can be proved to be the result of learning and long periods of practice...

It can be argued from the above that perceptions are developed not only from long periods of learning but also as a result of long periods of practice. It is for this reason the schools that participated in the study were purposively chosen because they taught computer science as a subject and use ICTs in the delivery of other subjects like mathematics. Therefore, the pupils and teachers from such schools are likely to develop certain kind of perception because of long periods and experiences in learning mathematics and other subjects using ICTs, hence the adoption of Hebb's theory. Malim and Birch (1998: 150) [15] define perception as "...the process whereby the brain makes sense of the information received from senses." In other words perception is the subjective interpretation of sensations in the light of experience, motivation and emotion and contextual factors.

Further, perception is not simply determined by stimulus patterns but rather it is a dynamic searching for the best interpretation of the available data as suggested by Gregory (1996). [8] In his theory, Hebb was able to separate the effects of learning from that of innate ability. Therefore his theory as already pointed out is more or less a compromise between behaviouristic and Gestalt theories of perception. The pupils and teachers from schools that participated in the study may not all of them necessary have been taught using ICTs but because the policy is being implemented in these schools, the later and former were able to remember through imagination, observation and experiences thereby developing perceptions about ICT adoption in the learning and teaching processes. Kuppuswamy (2012) [13] further attests that an individual maintains his/her contact with the outside world through perception. Once having perceived a phenomenon (in this case ICT adopting in education) one tends to retain the impression over a period of time and at any future time he/she can recall the experience through the process of remembering which is carried out by means of memory images. Additionally, Malim and Birch (1998) [15] correctly point out that past experience play an important role in perception formation. He further observes that under the characteristics of perception, familiarity and past experience of an individual are important factors in what and how one perceives. In agreement to the above, Kuppuswamy (2012) [13] adds that perception is selective; therefore, one may agree that if the influence of social learning on perception is accepted then the natural conclusion is that perception is selective.

Hebb's theory also suggests that the immediate attitude is important in determining the nature of perception. For example false perceptions are very common in case of intense needs. In other words, the momentary need and attitude play a significant role in determining perception. Additionally formation of social stereotypes is another evidence of the attitude affecting people's perception. In this case it is the social perception that is being influenced. The perception of certain undesirable traits in a particular community can easily be proved to be the result of certain attitudes that have been developed towards a particular group of individuals. Therefore people may ignore a great deal of reality (about ICT integration in the education sector for example) and allow their perceptions to be coloured with stereotypes that are told as postulated by Gregory (1996)[8] and Malim & Birch (1998).[15] One may argue that perceptions being selective and largely determined by condition of sense-organs and the nervous system, past experience, immediate attitude and formation of stereotypes entails that pupils' and teachers' perceptions towards ICT adoption in the learning and teaching of mathematics should be sought from the later and former themselves. This is on the premise that all the schools that participated in this study have been employing ICTs in the delivery of various lessons including Mathematics.

Further, perception is taken to be one of the most important aspects of human behaviour. In this regard, Nzuve (1999: 1) [24] summarises some of the factors that influence perception as illustrated in the diagram below:



Source: Nzuve, 1999 [24]

It can therefore be argued that depending on how people perceive things they may see the glass either as half-empty of half-full. However, despite such debates, one thing can be established that the more positively one perceives situation and circumstances the more efficiently he or she is able to avert a crisis. This clearly shows how powerful perceptions could be, hence the need to explore pupils' and teachers' perceptions towards ICTs in education. This further authenticates how this study best fits into Hebb's theory of perception.

1.5 Study Site

The study was carried out from selected secondary schools of Central Province. The selected schools were chosen because they had been teaching ICTs even before the policy of integrating ICTs in the Zambian education sector became mandatory in all public schools. Therefore, it was feasible to measure how perceptions influenced ICT implementation as main variables in this study because both pupils and teachers had a long history and experience on using ICTs in their learning-teaching processes.

1.6 Literature Review

Taking a snapshot of reviewed literature so far, it is evident that very few studies have been carried out on the use of ICTs in the learning and teaching of mathematics and later on about pupils' and teachers' perceptions toward the integration of ICTs in the Mathematics education. However, there has been numerous researches and information on ICTs in education in general. The much literature on this subject could be due to an increasing recognition at global level about the critical role ICTs play in the national social, political and economic development as argued by Marker, McNamara & Walace (2002), [14] Alcantara (2001)[1] and ILO (2001).[11] This trend where ICTs are seen to be taking a central stage in development is referred to as 'information revolution' or 'knowledge economy'. This is the type of economy where knowledge is easily made available coupled with prompt provision of great ideas which are eventually actualised into tangible products and services that in-turn spark economic progress and growth (Castells, 2001). [3] The rapid development of new technologies and the challenge of educating the ever growing population of our children have necessitated not only global reforms but also the development of teacher education (Moon, 2004). [18] The global reform and development of teacher education has motivated educational institutions to redesign and restructure their teaching methods that are aimed at helping pupils equip themselves for the future real life endeavours. This global reform in education has become prominent mostly in North and South America, Asia, Europe and Africa (Craig, 2008). [5]

Most studies conducted at global level indicates that knowledge of ICTs makes the learners better able to participate with and relate to classmate and society in general, implying that pupils were not being left behind. Despite such huge benefit that can be drawn from using ICTs in the learning and teaching, pupils' and teachers' perceptions towards this subject has remained unexploited especially in area of mathematics education. In order to explore this subject under study, it was felt important to review relevant literature from the global, regional and Zambian perspectives. For instance, global studies on ICTs in the education were important to the study because they describe a similar trend in teaching and learning patterns where ICTs are increasingly being used in our modern classrooms later on in the learning and teaching of mathematics. Additionally, global studies further offer a platform on which a study can be built on such as this undertaking.

For example, a study by Saverinus (2008) [29] indicates that the role of ICTs is rapidly ever changing, especially with internet in education. It is also argued that being aware of the role of ICTs in human life, especially in educational activities, education authorities should be wise enough in implementing the strategies aimed at integrating ICTs in our Zambian schools. Another study by Williams (2004) [36] equally argues that research clearly demonstrates the potential of ICTs to increase motivation and autonomy in learning and in improving retention. It is clear from the global studies by Saverinus and Williams that when effectively and efficiently used, ICTs are increasingly having a positive effect in the learning and teaching of mathematics, such as increased motivation among pupils and teachers, autonomy in the learning and improved retention levels coupled with the promotion of pupil centred learning activities as opposed to teacher dominated curriculum. What remains to explore is how these pupils and teachers perceive the use and integration of ICTs in acquisition of mathematical and pedagogical skills, hence this study?

Studies from the African region show variant trends as regards to the use of ICTs in education particularly in the learning and teaching of mathematics using modern technologies. According to Encarta (2009),[7] Africa is the second largest continent of the Earth's seven continents, covering 23% of the world's total land area and containing 13% of the world's population. According to the Sub-Saharan African Education for All Framework for Action, 1999), [31] Africa lags behind both in economic development and the use of ICTs. However, studies done by Shafika (2007) [30] and UNESCO (2013) [33] shows evidence that there has been a handful of successful ICTs implementations that are emerging in some African countries. Despite such tiny success stories, research on the use of ICTs in Sub-Saharan African education systems especially in the learning and teaching of mathematics remains thin. Regardless of this gloomy picture, most of the African countries have developed, or are in the process of developing a road map for the incorporation of ICTs in their education systems. Some have detailed implementation plans with priorities and timetables and measurable indicators already put in place. In this regard

and according to NEPAD (2001), [21] most African countries have planned to embrace ICT accessibility in their national development plans (NDP) and Africa Future Projects (AFP). Various studies by the World Bank, UNESCO, NEPAD, UN, African Development Bank (ADB), Commonwealth of Learning (COL) and other organisations indicate that ICTs are fostering conducive teaching and learning environments for many countries in African. Clearly, these statistics point to the fact that most African countries including Zambia are still struggling with ICT policy issues, ICT infrastructure challenges, ICT human resource development and lack of adequate budgetary constraints to fully integrate ICTs in their respective education sectors. It therefore imply that most of the African countries have not yet directed their studies on ICTs to explore pupils and teachers' perceptions towards ICT use in the learning and teaching processes hence this study.

The Zambian history of ICTs goes back to 1913 when the first manual phone was installed in Livingstone which was the then capital headquarters of Northern Rhodesia. Until the country's attainment to multiparty and liberalism in 1991, the provision of ICTs was solely the monopoly of the state. However, since 1991, Zambia, like many other countries on the African continent, has been integrating ICTs in various sectors of its economy of which education is one such a sector. Currently, the education system of Zambia has seen various technologies that are being applied thereby shaping the way education delivery is being conducted. A few examples include 'learning at Tionga market' which is an interactive radio learning programme, e-learning through the use of internet, CDs, DVDs and the recently introduced and approved by Ministry of General Education ZEDUPAD which is an electronic device with pre-loaded learning and teaching materials. Some of these programmes were not sustained either due to lack of adequate policy or financial resource constraints as most of these are funded by Non-Governmental Organisations (NGOs). Once the responsible NGO pulls out, the project tends to close.

In order to seal up some of the policy loopholes, Habeenzu (2010) [9] reports that in 2001, government, with the assistance from the Japanese International Cooperation Agency (JICA) and the United Nations Development Programme (UNDP), embarked on the formulation of a National Information and Communication Technology (ICT) policy. The policy formulation process was completed in 2005 and it was anchored on thirteen pillars of which the third pillar relates to education. Part of this pillar reads "Education-To integrate ICTs in the education systems and nation's research and development" (Habeenzu, 2010).[9] It is evident that the Zambia National ICT policy also recognizes the potential role of ICTs in education as stated in the thirteen pillars and objectives of the policy document. It has further been noted that in the recent years, ICTs have been introduced in a dynamic way in the Zambian education sector. For instance, with the support of the International Institute for Communication and Development (IICD), the Commonwealth of Learning (COL) and the United States Agency for International Development (USAID), the Ministry of General Education (MoGE) together with the Ministry of Communications and Transport developed a National Information and Communication Policy (NICP, 2006). [22] This was done as a way of providing and promoting lifelong education and training to all the citizenry. It should also be noted that the ICT policy was formulated in line with the vision 2030 and the Fifth National Development Plan (FNDP) which has now been replaced by the Sixth National Development Plan (SNDP).

According to the Ministry of Communication and Transport (MOCT) (2006: 3), [16] the Zambian education system encounters numerous challenges which may have a bearing on how teachers and pupils perceive the adoption of ICTS in schools and some of such constraints include the following:

- Financial and technological constraints,
- Inadequate awareness on the benefits of integrating ICTs in the education sector,
- Lack of coordinated approach in the adoption and implementation of initiatives targeted at the development of ICTs within the education system, and
- Shortage of teachers with ICT skills to meet the requirements of the schools thus limiting ICT penetration within the education system.

Like at regional level Zambia as a nation is still faced with the challenge of full implementation of ICTs in the education sector. Despite numerous efforts by government to promote the adoption of ICTs in Zambian schools such as the first ever ICT practical examinations, the nation is still addressing issues concerning inadequate electricity supply, computers and other ICT tools (Phiri, 2012) [27]. This is a clear sign that pupils' and teachers' perception towards ICT use in the learning and teaching of Mathematics has not received the attention the problem deserves, hence this study.

Some of these challenges that impact pupils' and teachers' perceptions are amplified by Hope (1996)[10] and Nyambe (2015)[23] who argued that although inadequate funding, equipment, lack of time and knowledge are known obstacles to a successful integration of ICTs in schools, the use and application of such technologies in the teaching and learning remain critical. Therefore, there is every need for the education sector to meet both pupils' and teachers' technological needs as a way of responding to their beliefs towards ICT adoption in their daily learning-teaching lessons. This is because teachers' beliefs and values are significant when determining their perceptions and attitudes as learning and thinking largely depends on one's beliefs and values. In the first place, if teachers' perceptions are to be altered towards technological adoption, teachers have to contend two major factors, firstly the psychological effect of change and secondly learning on how to use microcomputer technology. Therefore, understanding teachers' beliefs toward technology plays a critical role if ICTs are to be adopted successfully in the education sector. To that effect, a survey that was done by Sugar, Crawley & Fine (2004) [32] revealed that teachers who received laptop computers increased their technology confidence, skills and were more likely to remain teaching using ICTs. Additionally, teachers who participated in a two-year technology integration program improved their technology self-efficacy and their interest in learning more about ICTs and how they could impact on the curriculum.

A study by Ross, Pankati & Springer (1999: 87) [28] further confirm "...access to ICTs increased teachers' opportunities for successful teaching experiences, thereby contributing to greater confidence in their instructional ability." Ross et al (1999: 93) [28] furthermore noted "...teachers who interpret their interactions with computers as indicative of high ability grow

in self-confidence, regardless of their experience." The study also revealed that before teachers could use ICTs for instruction they must be personally convinced of its benefits and see the utility of employing a particular technology. It was therefore concluded that teachers had the desire to apply ICTs in the teaching and learning activities but what the study did not establish were teachers' perception toward using ICTs in teaching and learning of mathematics. However the study identified five salient beliefs that shaped teachers' perceptions towards adoption of new technologies in the education sector and these were: preparing pupils for their future careers, exposing pupils to a variety of new technologies, holding pupils' interest, enabling pupils to gain additional skills and making pupils too dependent on technology. The study concluded that not only did the teachers understand the importance of ICTs but displayed a positive attitude towards the integration of ICTs in the learning and teaching processes. It can be argued that although the study managed to establish teachers' attitudes, such perceptions were on education generally and not on the teaching and learning of mathematics (Mtanga, Imasiku, Mulauzi & Wamundila (2012).[19] This study still remains relevant in that it sought to establish pupils' and teachers' perceptions toward the learning and teaching of mathematics using ICTs. As stated by Hebb's theory of perception that one's past experience, beliefs, attitudes and values play a role in perception formation. In adopting Hebb's theory, this study purposively chose those schools that have been teaching ICTs for a long time to determine how both pupils and teachers perceived the phenomenon of integrating ICTs in their learning and teaching processes. The methodological and research design issues that posed challenges in the previous studies reviewed have been addressed in this study hence closing the knowledge gap which other research works left. Above all, many studies that have been reviewed dwelled much school administrators, parents, ICT policies and financial and human resource constraints but this study decided to deal with the direct beneficiaries of ICT education which are pupils and teachers.

2. Methodology

The study employed both qualitative and quantitative research paradigms. These approaches were triangulated in order to attain high levels of reliability and validity of the data collected and outcome of the study.

2.1 Research Design

The study used descriptive survey research design to establish pupils' and teachers' perceptions towards ICT integration in the teaching and learning of mathematics in selected secondary schools of Central Province, Zambia. This design was suitable because it sought pupils and teacher's opinions, beliefs and perceptions about the integration of ICTs in mathematics education. Moreover, Osuala (2001) [26] attest that descriptive research design is suitable for a study like this one because it reduces researchers' biasness and errors thereby increasing the probability of generalising research findings.

2.2 Population

Teachers of Mathematics and pupils from selected secondary school of Central province, Zambia constituted the target population for this study.

2.3 Sample Size

A total of 150 respondents participated in the study. The sample comprised fifty (50) Mathematics teachers, non-Mathematics teachers and one hundred (100) pupils. The demographic characteristics of the respondents drawn from the sample population are tabulated in Table 1 below:

Category of the sample population	Male	Female	Total	Percentage
Teachers of Mathematics	18	2	20	13.3%
Non Mathematics Teachers	25	5	30	20%
Pupils	50	50	100	66.7%
Total	93	57	150	100%

2.4 Sampling Procedure

Stratified and random sampling procedures were employed to sample non Mathematics teachers and pupils. The two sampling techniques were chosen in order to accord all non-mathematics teachers and pupils' equal representation and chance of being selected. The teachers of Mathematics were purposively selected because of their role of teaching mathematics.

2.5 Instruments for Data Collection

Questionnaires and scheduled interviews were the main instruments used to collect data. The questionnaires were preferred as they helped collect data from respondents objectively, faster and suitable especially when dealing with quantitative data set. On the other hand, scheduled interviews helped address some of the shortcomings from the questionnaires such as inability to ask follow-up questions and lack of obtaining in-depth meanings of the responses from participants.

2.6 Data Analysis

A combination of excel and Statistical Package for Social Science (SPSS) was used to analyse quantitative data which helped in producing frequencies, tables, figures and other important descriptive statistics for easy analysis of data. While qualitative data were analysed thematically by following emerging themes and sub-themes. Ethical research issues such as respondents' privacy, confidentiality, consent and the right to either participate or not into the study were fully upheld.

3. Findings and Discussion

In order to establish how pupils perceived the use of ICTs in the teaching and learning of Mathematics, the respondents were asked to give their responses on each of the following statements which are presented on the likert scale below:

Table 2: Pupils' views on the use of ICTs in the learning and teaching of Mathematics

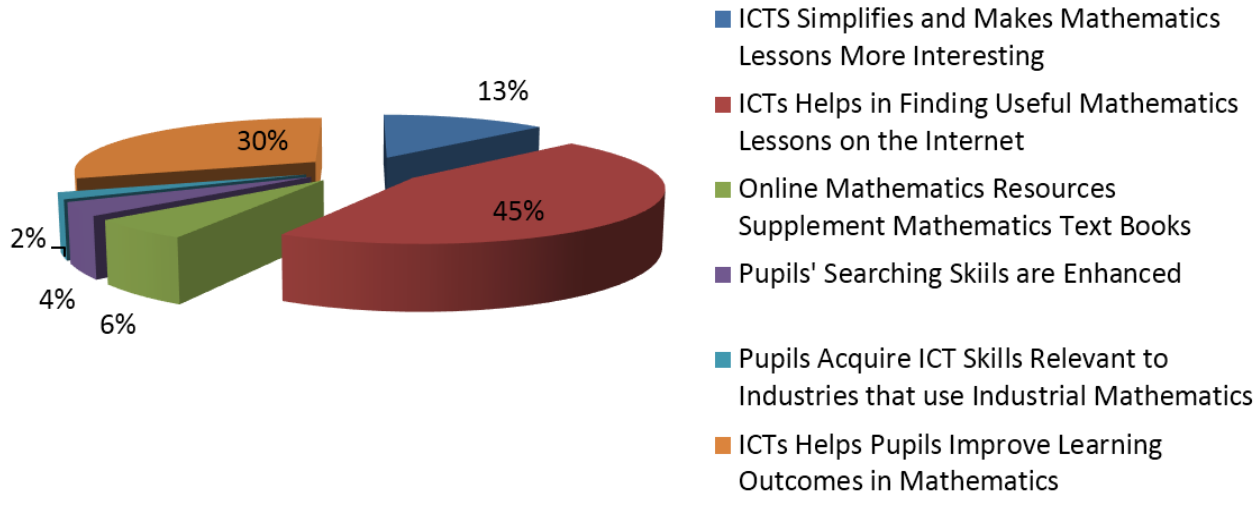
Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I think the application of ICTs when learning Mathematics is good	42(42%)	39(39%)	13(13%)	4(4%)	2(2%)
I'm always interested to use ICTs in learning Mathematics	35(35%)	41(41%)	9(9%)	14(14%)	1(1%)
I encourage my fellow pupils to apply ICTs when learning Mathematics	28(28%)	35(35%)	20(20%)	10 (10%)	7(7%)
I prefer using ICTs to traditional approach when learning Mathematics	14(14%)	39(39%)	25(25%)	11(11%)	11(11%)
I easily understand Mathematical concepts when I use ICTs	32(32%)	32(32%)	20(20%)	9(9%)	7(7%)
ICTs should be encouraged when learning and teaching Mathematics	41(41%)	35(35%)	13(13%)	6(6%)	5(5%)

Source: Field Data (2015)

As shown in table 2 above, pupils were asked to indicate the extent to which they agreed or disagreed on the use of ICTs in learning Mathematics. 81 out of 100(81%) respondents firmly agreed to the statement 'I think the application of ICTs when learning Mathematics is good', while 13(13%) remained neutral and 6(6%) disagreed to the statement. On the other hand the majority of the pupils 76(76%) agreed to the statement 'I'm always interested to use ICTs in learning Mathematics', and the minority 9(9%) and 15(15%) were neutral and disagreed respectively. As regards to the statement 'I encourage my fellow pupils to apply ICTs when learning Mathematics', 63(63%) agreed, 20(20%) opted to remain neutral while 17(17%) did not agree. Pupils were further asked to indicate the extent to which they agreed or disagreed to the statement 'I prefer using ICTs to traditional approach when learning Mathematics', the outcome were as follows: 53(53%) agreed, 25(25%) neutral and 22(22%) disagreed. When pupils were asked for their views on the statement 'I easily understand Mathematical concepts when I use ICTs', it was established that 64(64%) agreed, 20(20%) decided to remain neutral and 16(16%) answered not in favour of the statement. In another instance the respondents (pupils) were required to indicate whether or not ICTs should be encouraged in the learning and teaching of Mathematics, 76(76%) answered affirmatively in favour of the statement while 13(13%) neither agreed nor disagreed and the minority 11(11%) disagreed.

The respondents were further asked to indicate their perceptions on how ICTs enhanced the learning and teaching of Mathematics. The findings are hereunder presented in figure 1:

Figure 1: Pupils' Perceptions on How ICTs Enhance Learning Process in Mathematics



Source: Field Data (2015)

The results presented in figure 1, show that majority of the pupils 45 (45%) firmly perceived ICTs as being helpful in finding useful Mathematics materials on the internet. These were followed by those 30 (30%) who stated that ICTs helped them improve in their learning outcomes in Mathematics. The least 2 (2%) were those who said ICTs helped them acquire skills which where relevant in the industries.

Teachers' perceptions towards the use of ICTs in the teaching of Mathematics were also sought and their views are given below:

Table 3: Teachers' Perceptions of Using ICTs in Teaching Mathematics

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Application of ICTs in the teaching of Mathematics is good	25(50%)	17(34%)	4(8%)	3(6%)	1(2%)
I have interest to use ICTs when teaching Mathematics lessons	6(12%)	2(4%)	11(22%)	28(56%)	3(6%)
I encourage pupils and my fellow teachers to apply ICTs when learning and teaching Mathematics	14(28%)	4(8%)	10(20%)	20(40%)	2(4%)
I would rather use ICTs than Traditional approach when Teaching Mathematics	8(16%)	5(10%)	9(18%)	25(50%)	3(6%)
When I use ICTs, my Mathematics lessons and concepts become easier to understand	5(10%)	11(22%)	4(8%)	29(58%)	1(2%)
I feel every Teacher should use ICTs more in the Teaching of Mathematics	23(46%)	10(20%)	7(14%)	2(4%)	8(16%)
I feel competent to Teach Mathematics and communicate with pupils using ICTs	13(26%)	2(4%)	3(6%)	28(56%)	4(8%)

Source: Field Data (2015)

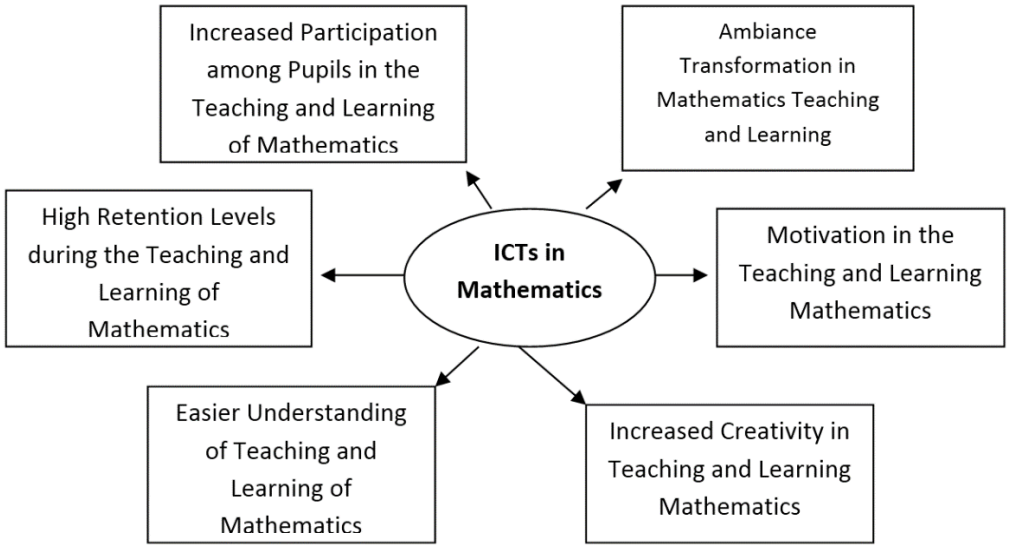
The findings presented in Table 3 reveal that majority of teachers 42(84%) acknowledged that it is good to teach mathematics using ICTs, 4 (8%) remained neutral and disagreed respectively. As regards to interest by teachers in using ICTs when teaching mathematics, most of the respondents 31(62%) did not show interest while the minority 8(16%) showed interest and 11 (22%) opted to remain silent. The statement which sought teachers' views on whether they encouraged pupils or fellow teachers to apply ICTs during mathematics lessons, the majority 22(44%) did not do that, 18(36%) did, while 10 (20%) were not decided between the two options of either agreeing or disagreeing. The choice to use ICTs unlike traditional approaches of teaching mathematics, 28(56%) which were the majority disagreed, 13 (26%) did agree and 9 (18%) remained neutral. Most of the teachers 30(60%) who participated in the study admitted that they did not find mathematics concepts easy when they used ICTs, 16(32%) did while 4(8%) did not give any response. As regards to the statement 'I feel every teacher should use ICTs more in the teaching of Mathematics' the majority 33(66%) firmly agreed, 10 (20%) disagreed and 7 (14%) remained mute. The other statement 'I feel competent to teach Mathematics and communicate with pupils using ICTs' of which the teachers were asked to respond, 32(64%) disagreed, 15(30%) agreed and the minority 3 (6%) indicated neither of the options.

As argued by Hebb's Theory of Perception, it can as well be deduced that pupils' and teachers' past experiences, attitudes, interests and long periods of learning determined to a greater extent how they perceived integration of ICTs in the learning and teaching of Mathematics. Although both teachers and pupils showed some level of positive perception towards using ICTs in the Mathematics teaching and learning processes, pupils however appreciated the use of ICTs in mathematics more than teachers. These findings are in conformity with the outcome of the study conducted by Mtanga, Imasiku, Mulauzi and Wamundila (2012) [19] that revealed that from the pupils' perspectives, integrating ICTs in the teaching-learning process improved learning process. The study further indicated that teachers' perceptions of integrating ICTs in the teaching-learning process were a little disappointing in that a few (48%) of the teachers felt the ICTs could bring benefits. One possible explanation why pupils were more positive about using ICTs in learning Mathematics than teachers was that pupils were in constant use of ICTs even when they are not in school. Social media such as facebook, whatsapp and twitter are some of the ICT facilities that have drawn the interest of youths. The unfortunate part however is that despite pupils' positive perception of ICTs, the youths tend to abuse these facilities in most time at the expense of using them for academic purposes. For example, Zambia Information Communication and Technology authority (ZICTA), a statutory body established by the Act of Parliament to regulate ICTs in Zambia is torn apart between banning the use of social media in schools or promote it so that they can be used to deliver quality education to these very youths who are abusing such facilities.

In addition, pupil's perceptions towards ICT use in education later on in the teaching and learning of Mathematics were attributed to prior exposure to ICT tools before entering school or being employed as a teacher. In other words, teachers' previous knowledge about ICTs helped shape their perception of adopting ICTs in education. Sugar, Crawley and Fine (2004) correctly pointed out in their study that teachers who were exposed to computers either through a training or families were they came from; they tended to have developed a positive attitude towards the use of ICTs in teaching Mathematics. Similarly in this study, although the majority of the teachers acknowledged that it is good to teach mathematics using ICTs, they however did not teach the subject using ICTs due to lack of self-confidence, past experience, ICT facilities and lack of training to mention but a few. A very recent study conducted by Nyambe (2015) [23] in Southern province of Zambia revealed that pupils had a positive attitude towards the use of technology. These results were based on a single regression analysis between pupils' attitude and the use of technology which indicated that there was a positive relationship between the pupils' attitude and the use of technology in the teaching-learning of Mathematics. The outcome of the study by Nyambe, further authenticates the findings of this study which shows that the trends of responses from pupils were in support of the use of ICTs in learning of Mathematics.

Hebb's theory of perception furthermore established that one's' past experience determines one's formation of perception. The finding of this study has shown similar trends in responses from both teachers and pupils who participated in the study. For instance, some teachers especially those who had experience of teaching Mathematics through the use of computers, indicated a positive perceptions towards ICT use in education. Ross, et al (1999) slightly disagreed with the above outcome in that their study established that teachers who interpret their interactions with computers as indicative of high ability grow in self-

confidence, regardless of their experience. Despite such a difference in research outcomes, the bottom line is that before teachers could use ICTs for instruction they must be personally convinced of its benefits and see the utility of employing a particular technology. Furthermore, although the two categories of respondents who participated in the study showed relative different levels of perceptions towards integration of ICTs in education, the benefits of using ICTs in the teaching and learning of Mathematics can be summarised below:



Taking a snapshot on the findings of this study, it is clear that despite differences in levels of perceptions towards learning and teaching Mathematics using ICTs, our pupils and teachers are willing to take up the challenge of adopting ICTs in our education system. As argued by Mtanga et al (2012) that both pupils and teachers demonstrated high desire to improve their learning outcomes and teaching approaches by exploring various ICT facilities but such a zeal was being inhibited by limited ICT skills, facilities, motivation, exposure and training coupled with serious financial resource constraints. As a result, most of our teachers especially those in rural areas have not fully or even started in some instances exploring various possibilities that ICTs can offer to make their teaching of Mathematics not only enjoyable but also effective and efficient thereby delivering quality education to Zambian populace. Zambia cannot afford to lag behind in the area of exploiting technologies because in this 21st century, ICTs are not luxuries but necessities as they drive the development agenda in all sectors of our lives. Perhaps Mwewa (2011:600) [20] hit the nail right on its head in his observation:

The Zambia of the 21st Century must be different from the Zambia of the 1900s. Nations that will develop superior technologies will also be nations that will lead in the 21st Century. Zambia cannot afford to lag behind in this regard. Technology is one of the three ingredients of economic growth. The other two being capital and labour. The way a nation manipulates these three determines how rich or poor that nation will be...Technology is closely linked to productivity...Technology does to a nation what education does to an individual...Technology improves a nation's efficiency and triggers higher productivity...Emerging Zambian leaders have both the mandate and political obligation to ensure that Zambia becomes a regional star in the development of superior technologies...

Indeed, the above observation can only be realised if and only if our Zambian education system promotes and put ICTs at the centre of its education delivery agenda. The minds of our young generation should be exposed to the development and application of not only foreign based technologies but also our local innovations inverted by our own pupils and students thereby encouraging critical thinking, logic and reasoning hence giving our youths to obtain a problem-solving ICT education. This can only be done if ICTs are integrated in all sectors of development and more especially the education sector. Of course this will not be achieved by merely talking but through provision of selfless leadership at all levels, mobilizing financial, technical and human resources by all stake holders and not only government. These resources once sourced, they should be distributed across the nation without any political or partisan interference. Our pupils should be encouraged to do practical in ICTs, mathematics and sciences, and for all these to be actualised, the young people require resources which should be made available. This way, our pupils and teachers are likely to further develop a positive perception towards applying ICTs in the teaching and learning of Mathematics and education in general. Can Zambia successfully integrate ICTs in the teaching and learning of Mathematics? YES WE CAN. Let us just put our priorities right, work extra hard, persevere, provide selfless leadership and invest heavily in the education sector today in order for us to harvest and smile tomorrow.

4. Conclusion and Recommendations

The study sought to establish pupils' and teachers' perceptions towards integrating ICTs in the teaching and learning of Mathematics. It is evident from the study findings that both pupils and teachers held a positive perception about learning and teaching Mathematics using ICT facilities. Despite both pupils and teachers holding positive perceptions, pupils however were more appreciative of the benefits of integrating ICTs in learning and teaching of Mathematics than the teachers. Such a difference mainly lies on what Hebb theory of perception has advanced that past experience, beliefs, attitudes, long periods of learning and practice shapes an individual's perception. Therefore, the above stated influenced in one way or other participants' perceptions they held towards the application of ICTs in learning and teaching of Mathematics. It is also clear from the study that although teachers held positive views about ICT use in Mathematics, they were however

discouraged by inadequate ICT facilities and limited access to computers in schools. Nevertheless, both pupils and teachers were optimistic that the Zambian education system would benefit greatly in the long run if ICT was integrated effectively in the learning and teaching of Mathematics. Can Zambia integrate ICTs in its education system and later on in the teaching and learning of Mathematics? YES WE CAN. The solution lies right in our hands. The Zambian education system can be transformed into a competitive, effective and efficient sector through the adoption of ICTs by Zambians themselves and not foreigners. Let us set our priorities right, use our limited financial resource envelop profitably and invest such resources in productive sectors like education among others. YES WE CAN DO IT.

Based on the findings of the study, the following key recommendations emerged: 1. Given the participants' positive perception towards the use of ICTs in the teaching and learning of Mathematics, government through the Ministry of General Education (MoGE) and other stake holders in the education sector such as UNESCO should provide adequate teacher training in ICT skills and ensure easy to access computers, internet and ICT facilities. 2. Teachers of Mathematics should take keen interest in acquiring necessary ICT skills in order to enable them fully utilize available ICT facilities in schools. 3. Government through the Ministry of General Education, Provincial Education Officers (PEOs), District Education Board Secretaries (DEBs), school Boards, Head Teachers, parents and cooperating partners should provide schools with modern ICT infrastructure and facilities that have both international and local or Zambian appeal. 4. Government and other key stake holders should initiate a proactive rather than a reactive approach in the implementation of ICTs in education such as having SMART implementation plans, budgets, political will and adapting to the 'Borrow –to-Adapt' and 'Brain-Earn' concepts.

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