# THE ROLES AND IMPORTANCE OF TECHNOLOGY IN MATHEMATICS TEACHING AND LEARNING-A LITERATURE REVIEW

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**Abstract**
There has been a general consensus among industry watchers, educational executives and several other stakeholders on the need to continually demonstrate the promotion of critical thinking and practical interdisciplinary education for engineering technology students. They also agreed that instructions of many practical technical applications require the utilization of mathematical concepts necessary for parametric analysis and problems solving methods. Problem solving is characteristics of mathematical activity and an important way of developing mathematical and analytical knowledge. A main purpose of mathematics teaching and learning is to develop the ability to solve a wide variety of complex mathematics problems. However, the process of problem solving in mathematics has not been given the proper recognition, probably due to the fact that teachers themselves are not comfortable with problem solving. As a result, teachers do not teach the process and technique of problem solving as an integral part of mathematics learning process. This paper aims at conducting an indebt literature survey and unveils the roles and importance of mathematics teaching and learning through the use of technological applications. To investigate prospective mathematics teachers' beliefs on technology usage in classroom mathematical problem solving. Also make recommendations to educational policy makers and other stakeholders in the industry for proper and timely decision making.

**Keywords**: Technology tools, Mathematics, Problem Solving, Teaching and learning

## 1.0 Introduction

In educational management, the relevance of technological equipment has been highly recognised especially in the teaching of mathematical problem solving.Kauchak and Eggen,(2008) emphasized on the changing nature of teaching and learning in the 21st century and the controversies that surround the application of technology in learning (Ajagbe et al.,2011a; 2011b). Especially the problems teachers encounter in the construction of realistic complex problems for their students. They however, pointed out that the kind of problems experienced in real life by people is totally more complicated than what students are made to work on in the classroom, which they perceive as been too direct and straightforward hence, not tasking enough. There is further argument on the impact technology tools have been having in "changing both teaching and learning in the 21st century and controversies exist about its application" (Kauchak and Eggen, 2008: Mkomange, 2012). Many authors have revealed that part of the challenges teachers encounter when they try to teach their students to solve problems is the difficulty of constructing realistic complex problems for them. All too often when students encounter word problem in mathematics, for example, the goal is clear. Only the numbers needed for the solution are included, and even the type of computation needed to solve the problem is suggested by the problem's placement in a particular chapter ( Kauchak and Eggen, 2008). Unfortunately, these are not kind of problems most people encounter in their everyday lives. Real-life problems are messier and more complicated, with a number of viable routes providing alternative solutions (Mkomange, 2012: Ertmer, 2005).
A number of researches recommended that, Technology provides one way to teach students how to solve these kinds of problems. As the main objectives of this study are to investigate prospective mathematics teachers' beliefs about the use of technology in mathematics instruction while solving mathematical problems, and to unveil the roles and importance of technology tools in mathematics teaching and learning. As beliefs have a considerable effect on individuals' actions, teachers' beliefs play a crucial role in changing the ways teaching takes place. Research suggests that teachers' beliefs are importantly linked to teachers' classroom practices and, consequently to students' learning in mathematics (Brown, 2003). And also agree that there is a moderate but growing literature on teachers' beliefs about mathematical problem solving.

## 2.0 Literature Review

### 2.1 Mathematics

Mathematics is not only a subject; it is related with many things in human's daily life. Its study provides students with certain basic life skills and processes that will prepare them to be productive members of society. We do use variety of mathematics skills and processes such as, we tell time, we decide on the best product to buy, we read graphs (understanding statistical information) in the news paper, we do financial planning and so on (Charles and Lester, 1984). Brown (2003) reported that the mathematical body of knowledge is not static and inert but changing and expanding. As a result of this there is a shift from psychologically oriented view to a more socio-psychological interpretation of how learning takes place; there has been similar shift in philosophical issues related to mathematics education. It is recognized that mathematics, just as any other subject, grows and changes as a result of problem solving, trial and error and the interpersonal exchange of ideas. Mathematical activity is an essential part of almost every profession, such as business, science, weather prediction, medicine, engineering, architecture, and economics (Charles and Lester, 1984). The content of mathematics curriculum must focus on ways to equip students with an ability to learn things that no one yet knows; such focus implies a different role for mathematics teachers. As well known, in a traditional way of teaching, mathematics teachers have concentrated their efforts on helping their students acquire computational skills, instead of emphasizing concept constructions.

### 2.2 Mathematical Problem

A word problem may have different meanings to different people depending on their personal perceptions. Normally, problem is explained as any situation for which a resolution is needed, and for which a direct way of solution is not known (Polya, 1962). Mathematically, problem is something that have not been previously found and has no immediately obvious solution by the current knowledge or information available. In mathematics classrooms daily teaching, problem is defined as something that students are willing to solve but they have no existing predetermined mathematical steps to solve, but students have needed factual and procedural knowledge in mind of resolving it (Schoenfeld, 1989;2007). A mathematics problem can be a routine or a non-routine one. Routine problem is the one that practically contains at least one among the four basic arithmetic operations or ratios (Altun, 2001), whereas non-routine problem is one that typically deals with developing mathematical reasoning to students and enhancing their understanding of the nature of mathematics as a creative subject matter. It is also important to differentiate between a mathematics problem and an exercise. As (Polya, 1953) emphasized that basically exercise intents to verify the application of new learned mathematical facts, such as mathematical terms or symbols, that easily enable students to do classroom exercises. Nevertheless, basically, a problem cannot be solved by ordinary existing information (Frensch and Funke, 1995).

As opined by (Henderson and Pingry, 1953) solving a problem, involves a crucial approach to arriving at a solution but trying to "outline a method to solve it". In essence there is no unique invention involved in doing mathematical exercises but there are curiosities while solving problems and enthusiasm together with a challenge to students' intellect. The National Council of Teachers of Mathematics (NCTM, 2000) explains several characteristics of good mathematics problems to be the ones that contain clear and unambiguous wording, related to the real world, engage and interest students, not readily solvable by using a previously taught algorithm, promote active involvement of students, allow multiple approaches and solutions, and connect to other mathematical concepts and to other disciplines. Problem solving is the process that mostly not deals with simple recall of new well-learned facts and procedures (Lester, 1994). NCTM (1989) go further to explain that it is a process by which students experience the power and usefulness of mathematics in the world around them, as well as being a method of inquiry and application. Mainly, it encompasses skills and functions which are important part of everyday life by which students can perform effectively when situations are unpredictable and task demands challenge. In reality, problem solving is more than a vehicle for teaching and reinforcing mathematical knowledge, and helping to meet everyday challenges; it is also a skill which can enhance logical thinking aspect of mathematics (Taplin, 1988). Polya (1973) states that if education is unable to contribute to the development of the intelligence, then it is obviously incomplete; yet intelligence is essentially the ability to solve problems both of everyday and personal problems. Moreover, while students are solving problems, they experience a range of emotions associated with various stages in the solution process and feel themselves as mathematicians (Taplin, 1988). Problem solving has been used in school mathematics for several reasons. Stanic and Kilpatrick (1989) identified three general themes that have characterized the role of problem solving in school mathematics, namely problem solving as a context, problem solving as a skill, and problem solving as an

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art. The former one indicates that problem solving has been used as justification for teaching mathematics; that means, in order to persuade students of the value of mathematics, that the content is related to real world problem solving experiences (Stanic and Kilpatrick, 1989b). In summing up, problem solving has been given value from nursery school to high school as a goal to student mental improvement, as skills to be taught and learned, and as a teaching technique in mathematics education (Schoenfeld, 1989; 2007 Polya, 1953). Particularly in the previous thirty years, problem solving has been promoted "not as an isolated part of the mathematics curriculum", but as "an integral part of all mathematics learning" (NCTM, 2000, p.52) in many countries such as England, Canada, Brazil, China, Japan, Italy, Malaysia, Singapore, Nigeria, Tanzania and the United States. In other words, teaching problem solving as a separate skill or as a separate topic has shifted to infusing problem solving throughout the curriculum to develop both conceptual understanding and basic skills (Stanic and Kilpatrick, 1989). Currently, in many African countries (Nigeria and Tanzania), problem solving has been emphasized as essential part of mathematics curriculum and as one of the main significant skills to be learned and demonstrated in each subject matter.

2.3 Teacher Beliefs and Learning Theories

Currently the field of mathematics education laid more emphasis on the problem solving as the approach to be used into day-to-day mathematical lessons. Beliefs have been defined as "Conceptions, personal ideologies, world views and values that shape practice and orient knowledge" (Aguirre and Speer, 2000). An individual's belief system is a compound of one's conscious or sub-conscious beliefs, hypotheses or expectations and their combinations. For example, beliefs are considered equal to concepts, meanings, propositions, rules, preferences or mental images (Thompson, 1992). On the other hand, beliefs are seen in a much broader sense as "mental constructs that represent the codifications of people's experiences and understandings" and that shape their perception and cognition in any set of circumstances (Schoenfeld, 1998;2007). Teachers beliefs about mathematical problem solving and the influences on their beliefs are thought to have major impact on implementation of the current innovative way of learning mathematics (Chapman, 2002).

Previous authors have focused on traditional views, formalist views, constructivist views and problem solving approaches to teaching in relation to practices, further the categories of teachers' beliefs about mathematical problem solving can be reconstructed. Traditional views are based on theory whereby students learn facts and concepts and they understanding by absorbing content through teachers explanations or by reading it from recommended textbooks (Ravitz, Becker and Wong, 2000). The main characteristics including learners construct their own understanding, new learning depends on current understanding, learning is facilitated by social interaction, and meaningful learning occurs within authentic learning tasks (Kauchak & Eggen, 2008). Cooney & Wilson (1995) also found that the beliefs about mathematics held by pre-service teachers considerably changed after participating in a teacher education program that promoted the NCTM standards and the use of technology. They found that after engaging in reform oriented activities during their teacher education coursework, prospective teachers more deeply understood the subject matter and significantly changed their previous perceptions of mathematics and how to teach the subject.

Both teachers and students beliefs are significant factors in order for these innovations in the mathematics curricula to take place in classrooms. In Chapman (2002) study he emphasized that the implementation of innovative methods of day-to-day teaching into mathematical instructions have been thought to have a significant impact on teachers' beliefs about mathematics and mathematics education. It is however revealing to state that teachers' beliefs about teaching and learning have powerful effect on teachers' pedagogical decisions because what a problem solver think and do is a reflection of his or her beliefs. Referring to similar findings of Bishaw (2010) which revealed that there exists high relationship between teachers' beliefs towards problem solving teaching method and their actual classroom practices and thereby students' achievement. This is consistent with Stipek el al (2000) that, "beliefs and practices are interconnected, and emphasize that teacher professional development be emphasized on both side in order to achieve success". Beliefs develop highly gradually and do not change easily (Abelson, 1979). Especially, central beliefs which are more grounded and held more strongly are "less open to rational criticism or change compared to peripheral beliefs which are more open to examination and possible change" (Turner and Chauvot, 1995). So modifying or changing these strongly held beliefs will have far more reaching consequences than changing the others (Op't Eynde, De Corte, and Verschaffel, 2002). Hollifield (2000) and Anderson (1995) suggested that if reformers want to improve the content and methodology used in teaching, they need to give their attention to previously formulated beliefs and dispositions of teachers and students. Hollifield (2000) emphasized that "supplying new curricula, incentives, or regulations" are not sufficient to change teaching practices as long as "teachers do not understand or do not agree with the goals and strategies" proposed by these technology innovative way of teaching. In addition to understanding and agreeing with the new ideas, in order for teachers to willingly change their beliefs, they need to experience cognitive conflicts associated with their current state of teaching, decide to change, make a commitment to change, construct a vision to change, and reflect on their instructional practices (Brosnan et al., 1996; Wood, Cob and Yackel, 1991). Due to the fact that teachers play a major role in the lives of today's students and tomorrow's adults (Brown, 2003), and long lasting instructional changes only result from essential modifications in what teacher's believe, know, and practice. It becomes vitally imperative to understand teachers' beliefs and the factors influencing these beliefs and how these beliefs affect their classroom practices. The main problem is that teachers do teach mathematics in a way they have been taught; and they have strong believes that make restriction to change ideas about teaching procedures (Cooney, 1996). He also argued that reform at classroom level is in its infancy. Teachers believes are the main issue in term of changes in their teaching; but as Guskey (2002) suggests; changes in teacher's believes and attitudes follow changes in students outcomes which, in turn, follow changes in teacher practice and this is indicated in the Figure 1 which he proposed:

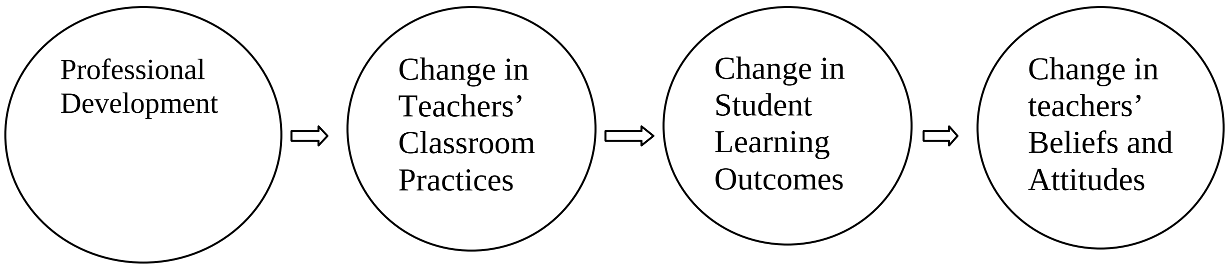


**Figure 1**A Model of Teacher Change (Guskey, 2002).

*2.4 Importance of Problem Solving in Mathematics Education*

As it has been announced by National Council of Teachers of Mathematics (NCTM, 1989), problem solving is an integral part of all mathematics learning. In everyday life and in the workplace, being able to solve problems can lead to great advantages. It has already been pointed out that mathematics is an essential discipline because of its practical role to the individual and society. Through a problem solving approach, this aspect of mathematics can be developed. Presenting a problem and developing the skills needed to solve that problem is more motivational than teaching the skills without a context. Such motivation gives problem solving special value as a vehicle for learning new concepts and skills or the reinforcement of skills already acquired (NCTM, 1989). Quite a number of researchers such as (Brown, 2003; Jonassen, 2004; Manuel, 1998) have investigated problem solving and has been given value as a goal for mental development, skill to be taught, and a method of teaching in mathematics education particularly three decades ago. Several countries like Brazil, China, Japan, Italy, Portugal, Sweden, the United Kingdom" (Lester, 1994) and the United States (NCTM, 2000) have promoted problem solving to take place in mathematics classes from nursery to secondary level. The reason for this strong emphasis adduced to problem solving instruction currently is because of the peculiarities and significance of problem solving not only for success in everyday living, but also for the future of our environment and advancement of labor. Problem solving has occurred since the first human being discovered the importance of shelter and food or to flee from the predators (Brown, 2003). The advancement of human environment resulted in unforeseen environmental contingencies, new problems discovered and led to the urgency to formulate alternative and new methods of finding answers to peculiar scenarios. Meanwhile, mathematics emanated as an answer to these requests and the improvement of mathematics presented more avenues to realize difficult tasks. Shroeder and Lester (1989) identified that Problems creates "an atmosphere for students to make known on their conceptions about the nature of mathematics and develop a relational perceptive of mathematics" as the most imperative task of problem solving in mathematics. They highlighted that understanding mathematics is fundamentally seeing how things connect together in mathematics, thinks that the taking down of notes and the act of memorizing mathematical problem solving steps by students prevents them from how things are connected or fit together . Essentially, a person's knowledge relating to mathematical ideas increases to a higher selection of contexts, as one relates a given problem to a superior number of the mathematical ideas implicit in it, or as one constructs relationships among the various mathematical ideas embedded in a problem".

*2.5 Approaches to Problem Solving Instruction*

Approaching mathematics through problem solving can create a context which simulates real life and therefore justifies the mathematics rather than treating it as an end in itself. The National Council of Teachers of Mathematics (NCTM, 1980) recommended that problem solving be the focus of mathematics teaching because, they say, problem solving encompasses skills and functions which are an important part of everyday life. Furthermore it can help people to adapt to changes and unexpected problems in their careers and other aspects of their lives. More recently the council authorized this recommendation with the statement that problem solving should motivate all aspects of mathematics teaching in order to give students experience of the power of mathematics in the world around them. They see problem solving as a vehicle for students to construct, evaluate and refine their own theories about mathematics and the theories of others. Due to the various roles adduced to problem solving by text book writers, classroom teachers and curriculum developers, it could be said that problem solving can be viewed from different teaching methodological approaches. Understanding the features of these methodologies is due to the need to look at the manners problems are applied in mathematics education, and the focus given to problem solving in mathematics curriculum dramatically becomes dynamic over time. One of the most well known distinctions made between these methods was described by (Kilpatrick,1978). He reported three basic techniques to problem solving instruction, and subsequently highlighted by (Schroeder and Lester in 1989). These basic approaches are, “teaching about problem solving”, “teaching for problem solving”, and “teaching through problem solving.”

2.5.1 Technology and Mathematical Problem Solving

Kauchak and Eggen (2008) pointed out that the use of Technology is “changing both teaching and learning in the 21st century and controversies exist about its application.” They go further to report that one of the dilemmas teachers encounter when they try to teach their students to solve problems is the difficulty of constructing realistic complex problems for them. All too often when students encounter word problem in mathematics, for example, the goal is clear. In the earlier report of the Cognition and Technology Group at Vanderbilt, they found that only the numbers needed for the solution are included, and even the type of computation needed to solve the problem is suggested by the problem’s placement in a particular chapter and emphasized that, these are not kind of problems most people encounter in their everyday lives. They opine that real-life problems are messier and more complicated, with a number of viable routes providing alternative solutions (Kauchak and Eggen, 2008; Mkomange,2012).

Drawing from observations of Ajagbe et al., (2011a) in their current study, that several emerging nations are fast realising the huge impact of information and communications technology (ICT) revolution in the 21$^{st}$ century thereby exposing the fact that more academic assignment, task and or responsibility cannot be effectively discharged without the use of one technology equipment or the other in order to achieve a high academic performance by students. This marks the essence of the advice to educational policy makers to adopt a methodology to officially incorporate the use of technology in teaching and learning (Ajagbe et al 2011b). They further argue that this will encourage and simplify students’ discharge of their educational responsibilities hence; resulting to a high academic performance. A number of researches recommended that, Technology provides one way to teach students how to solve these kinds of problems. As one of the main objectives of this study is to investigate prospective mathematics teachers’ beliefs about the use of technology in mathematics instruction while solving mathematical problems. That is why; this study realizes a reason that, it is essential to understand the role and importance of technology in mathematics teaching.

Technology is an important instrument in teaching and learning mathematics which enhances efficiency, communication, research, problem solving, and decision making (Niess, 2005), hence supporting students in their understanding and appreciation of mathematics. It has been recognized by several authors and expert in educational management that students can learn more mathematics more deeply with the appropriate and responsible use of technology”. Jurdak (2004) investigated the impact of technological apparatus, particularly computers, as facilitators in problem solving in mathematics education, and opined that technology can serve as a power for building bridges between abstract mathematics and problem solving in real life. Both calculators and computers were found to be reshaping the mathematical scenery, allowing students to work at higher levels of generalization and abstraction, thus resulting in a deeper mathematical understanding (Mathematical Association of America, 1991). Sang, et al (2009) and Teo (2008) found that ICT integration is influenced by the complex of students teacher’s constructivist teaching beliefs, teaching self-efficacy, computer attitudes in education and their computer self-efficacy. Findings agree that a need arose for teacher educators should re-strategize and re-evaluate the training methodology. Which they propound should be implemented in a constructivist learning environment and offer student teachers with a confidence in using computers for teaching and learning.

Mathematical Sciences Education Board (MSEB, 1989) found that the proper use of calculators can "enhance children's understanding and mastery of mathematics", especially in arithmetic, and that calculators allow "the growth of a realistic and productive number sense in each child". In the report of this board they observed that the students who used calculators learn traditional arithmetic as well as those who do not use calculators, and demonstrate better problem solving skills and much better attitudes towards mathematics. Juhary (2011) reported that in Malaysia, one of the Critical Agenda Projects (CAPs) under the National higher education strategic planning is e-learning. He emphasized that this suggestion is a direct emphasis on all higher learning institutions in the country to transform the processes of teaching and learning from a traditional mode to a more digital-based mode. Similarly, Mathematical Association of America (1991) emphasized that "given carefully designed instructions, computers can aid in visualizing abstract concepts and create new environments which extend reality"; therefore "separating mathematics from technology" will result in limiting students' mathematical ability. So, it was suggested that potential mathematics teachers should "use calculators and computers to pose problems, explore patterns, test conjectures, conduct simulations, and organize and represent data".

*2.5.2 Technology and Teacher Beliefs*

Several studies have been conducted to understand how technology is used in classroom environments (Becker and Ravitz,1999; Tawfik et al.,2008; Ajagbe et al., 2011b; Mkomange, 2012), which beliefs teachers hold towards teaching and learning with technology and how technology could support learners (Adiguzel and Akpinar, 2004; Ajagbe et al 2011a; Mkomange, 2012), and know how to integrate technology into the curriculum . For example (Sheingold and Hadley,1990; Tawfik et al., 2008) in an examination to find out ways in which teachers in USA adopt computers in their classrooms, how it impacted on their teaching, and the kinds of barriers experienced while integrating computers into their teaching. At the end of the study, the teachers reported that they had changed from being the only provider of information and knowledge in the classroom to sharing that role with students and providing more complex materials. Moreover, the students were found to be working with increasing independence as a result of computer usage. Therefore, it is concluded that technologies can help teachers to teach differently as well as providing more complex kinds of tasks for students to engage. Furthermore, it is proposed that in order to achieve these professional developments, teachers need adequate time and support while experimenting with technology, and designing and implementing good technology based activities within their curricula.

Abdul Raman et al (2003) identified an approach for novice mathematics problem solvers to be encouraged and also an attempt to encourage future teachers of mathematics to integrate ICT in the teaching and learning of mathematics. Their findings reveal that the student teachers' perception about problem solving in mathematics actually changed with the use of information and communication technology. Although they were quite apprehensive at first but they enjoyed the course and most importantly, they experienced a new perspective on mathematical problem solving. The role of information and communication technology is seen as supporting and enhancing the ability of the student teachers to solve mathematics problems. Most importantly, it changed the way the teachers see the problems and devise ways of teaching mathematical problem solving using technology in order to offer new and powerful learning environment for our future generations. With an intention to examine the level of technology usage in primary and high schools, (Becker and Ravitz, 1999) carried out a series of study between 1989 and 1997 in USA. The study in 1989 indicates that just a small proportion of teachers and students were main technology adopters because of inadequate access to technology. Contrary to the study of 1989, the study in 1997 took place in schools working with consistent access to information. In the study of 1997, there was an appreciation of the value of the use of technology as a result of adequate support for how to put into practice instructional changes together with adequate computer software and telecommunication resources for students use were made available.

Cooney and Wilson (1995) investigated secondary pre-service teachers' beliefs about mathematics through a teacher education program that promoted the NCTM standards and the use of technology. There was a considerable emphasis on different teaching methods and daily opportunities for the teachers to engage in activities including an extensive use of technology. Prior to this they believed that it was invaluable to waste time using the computer, while at the end of the workshop the teachers belief suddenly changed and they agreed that technology can significantly change the teaching of mathematics, however emphases should be given to the technology usage. Fey (1989) studied the impact of applying electronic information technology in creation of new environments in mathematics education, and listed several ways in which computer-based representations of mathematical ideas are unique and valuable for instruction and problem solving in mathematics. These are; computer representations of mathematical ideas and procedures can be made dynamic in ways that no text or chalkboard diagram can; the computer makes it possible to offer individual students an environment for work with representations that are flexible, but at the same time, constrained to give corrective feedback to each

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individual user whenever appropriate; the electronic representation play a role in helping move students from concrete thinking about an idea or procedure to an ultimately more powerful abstract symbolic form; the adaptability of computer graphics has made it possible to give entirely new kinds of representations for mathematics representation that can be created by each computer user to suit particular purposes; and the machine accuracy of computer generated numerical, graphic, and symbolic representations make those computer representations available as powerful new tools for actually solving problems."

Adiguzel and Akpinar (2004) designed and implemented a computer software, Labour Scale, which begins with the concrete representations and reaching the symbolic representations by using visual components supported by audio, to improve seventh grade students' word problem solving skills through computer-based multiple representations including graphic, symbolic, and audio representations. Students from both public and private elementary schools which had computer laboratories were administered pre-test and post-tests while studying work and pool problems in their classes. It was found that seventh grade students' performance on work and pool problems increased significantly through the application of this computer representation which assisted students with the transition from concrete experiences to abstract mathematical ideas, with the practice of skills, and with the process of problem solving. Ely (1990) proposed that in order for effective technology in-service programs to be successful, conditions should support the overall implementation of educational technology. Through careful examinations of several conditions, eight factors were detected that influenced the effective implementation of educational technology. These factors were dissatisfaction with the status quo, knowledge and skills, resources, rewards and incentives, commitment, leadership, time, and participation. For example, the factor dissatisfaction with the status quo suggested that there must be a reason for members of the system to want to implement technology. Also, in order to implement the use of any type of educational technology, teachers must feel confident in its operation and their own ability to integrate it into daily classroom practices. It was recommended that both hardware and software resources should be available, individuals at all levels of the system must participate in the innovation, and in order to encourage the implementation of innovations rewards and incentives can be used.

While examining the factors influencing the diffusion, adoption, and implementation of technology in education, Ely (1990) found the time factor to be the most emphasized one in almost all studies. Teachers believed that computers created more work for them, and even the accomplished technology using teachers rated the lack of time as one of the biggest obstacle to technology utilization in schools. Furthermore, it was stated that individuals should be given the opportunity to plan and participate in decisions concerning the innovation and its implementation. Using Ely's condition as a framework (Nawami et al., 2005) conducted a survey to determine the existence or non-existence of the conditions that encourage the use of computer by mathematics teachers in secondary schools in Malaysia. Their findings were consistent with previous findings of Ely. However, the condition of "commitment by those involved" was found to be the most prevalent while the condition "rewards or incentives exist for participants" was the least prevalent. The findings of the correlation analysis among conditions suggest that strong relationships exist between some of the conditions, such as "knowledge and skills" with "participation", "participation" with "commitment" and "commitment' with 'leadership".

Turner and Chauvot (1995) conducted a longitudinal study to conceptualize the belief structures of pre-service teachers with regard to technology. Several interviews, observations and examinations were administered to two pre-service through a four quarter sequence which consisted of two courses in mathematics education, student teaching, and a post student teaching seminar. During these courses, graphing calculators and computers were used as investigative tools and several activities took place which included the use of technology as an integrated approach to learning mathematics. During the study, it was found that teachers hold various beliefs such as "success in technology results from a prerequisite knowledge of mathematics"(p.5), "once the mathematical knowledge was obtained by paper and pencil skills, technology can be used for further mathematical investigation" (p.5), "technology should be used only in the upper level classes" (p.6), "technology is an alternative method of teaching, so it can be replaced with methods such as group work, manipulative, and peer teaching", and "technology can be used as a demonstrative tool" (p.7). It was stated that the belief structures of these pre-service teachers would play a crucial role in determining how and when these pre-service teachers would use technology in their future classrooms.

MSEB (1989) suggested that "priorities for mathematics education must change the ways technology is used in mathematics" (p.63). NCTM (2000) recommended mathematics teachers to redesign the mathematics they teach, investigate technological tools for learning mathematics, and consider how they can create an atmosphere where technology is used as a tool in students' learning mathematics. Also, it was stated that as all students regardless of their access to technology, deserve life opportunities arising from a quality education, "it is important not to wait for high access to technology, nor to pursue it to the exclusion of developing better models for its use" (Coppola, 2003).

For (Shakir, 2009) in his investigation of soft skills in Malaysia institutions of higher learning reported that critical thinking and problem solving skills are two important skills that graduates are supposed to develop appropriately in order to prepare them for challenges of the future. He emphasized that "*graduates should be able to think in a critical, creative, innovative, and analytical manner which includes the ability to apply knowledge" and go further to mention that "elements that graduates must possess under this aspect are the ability to identify and analyze complex situations as well as making evaluations that are justifiable, they should also have the ability to expand and improve thinking skills, to provide ideas, and alternative solutions"* (MOHE 2012).

**2.0 Methodology**

The methodology adopted in this study is conducting a deep study of several previous literature reviews with a view to unveiling author's empirical findings as regards to the subject of this research. The subject of this study is to understand the roles and importance of technology applications in mathematics teaching and learning. Also the study reviewed prospective mathematics teachers' beliefs on technology usage in classroom mathematical problem solving. In this survey, several empirical studies were review and a few documents also studied to arrive at the policy implications for all stakeholders and educational decision makers.

**3.0 Policy Implications**

It is no more news that technology applications in teaching and learning have evolved over the past few decades, especially in developed countries and recently emanating in the developing and least developed countries in Asia, Africa, South America and the European countries. Following the findings of several previous researches on this subject of discussions, it was revealed that the use and application of information and communication technology in classroom teaching and learning should not be underestimated. In various countries, educational policy makers have emphasized on the integration of this tools into day to day operations in the educational sector. This is in recognition of the significant roles, technology plays by providing a way to teach students how to solve different kind of tasking analytical and arithmetical problems. Also prospective mathematics teachers' beliefs about the use of technology in mathematics instruction while solving mathematical problems, it was revealed that prospective teachers should be prepared to integrate information and communication technology into their future teaching and learning practice, despite the increased availability of and support for technology education integration by many government relatively few teachers intend to integrate ICT into their teaching practices (Ertmer,2005) the available research has mainly focused on isolated teacher related variables to explain the weak level of ICT integration.also,most of this research was set up in western countries. This present study centers on the impact of policies surrounding the use of technology in teaching and learning in developing countries such as Tanzania and Nigeria to mention a few.The literature review revealed that mathematical problem solving are among the most important challenge facing educational policy makers in several countries in recent times. The shift from psychologically oriented view to a more socio-psychological interpretation of how learning takes place, there has been similar shift in philosophical issues related to mathematics education. This finding is consistent with Brown (2003) who recognized that mathematics just as any other subject grows and changes as result of problem solving, trial and error and interpersonal exchange of ideas. National Council of Teachers of Mathematics (NCTM, 1980,1989) recommended that mathematics curriculum should be organized around problem solving focusing on developing skills and ability to apply these skills to unfamiliar situation; gathering; organizing, interpreting and communicating information; formulating key questions, analyzing and conceptualizing problems, defining problems and goals, discovering patterns and similarities, seeking out appropriate data, experimenting, transferring skills and strategies to new situations, and developing students' curiosity, confidence and open-mindedness apply it in mathematics lessons. Also from the literature review, it was also found in consistence with Ely (1990) and other authors that in order for effective technology in-service programs to be successful, conditions should support the overall implementation of educational technology. Through careful examinations of several conditions, eight factors were detected that influenced the effective implementation of educational technology. These factors were dissatisfaction with the status quo, knowledge and skills, resources, rewards and incentives, commitment, leadership, time, and participation. It was recommended that both hardware and software resources should be available, individuals at all levels of the system must participate in the innovation, and in order to encourage the implementation of innovations rewards and incentives can be used.

In conclusion, finding from this review is particularly useful to developing countries who have not integrated information and communication technology usage into classroom teaching and learning to evolve strategies to effectively implement this policy for enhanced teaching and learning of mathematical problem solving.

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