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TEACHERS' PERCEPTIONS OF THE USAGE OF CALCULATORS IN THE TEACHING AND LEARNING OF MATHEMATICS AT THE JUNIOR HIGH SCHOOL LEVEL IN GHANA

RESEARCH ARTICLE

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ABSTRACT

Educational technology is recognized as an essential component of the instructional process and thus, uses of calculators have been recommended to be introduced in Junior High Schools in Ghana. However, teachers' attitudes towards the use of calculators have not been established. The purpose of the study was to investigate teachers' perceptions towards the use of calculators in mathematics instruction in JHS in Ghana. Descriptive research design was used and data were collected from mathematics teachers using questionnaires. The results indicated that teachers have positive perceptions towards the use of calculators for mathematics learning. The finding is helpful to curriculum developers and they can integrate the use of calculators in mathematics teaching and learning in JHS in Ghana.

INTRODUCTION

Background to the Study

In the twenty first century where technology has become essential in our everyday lives, Ghanaian mathematics teacher in the JHS level still have misconception with the use of calculator in the classroom. Some of the teachers argue that pupils will become lazy and the use of calculators will impair pupils' mathematical ability and result in increased mathematics illiteracy. Sadly, most of this teacher still thinks that learning mathematics in the 21st century is by rote memorization of multiplication tables and the very hot mental drills with canes. The recent Anambah –Mensah Educational Review Committee introduced a lot of changes to the old curriculum. Historically, teaching and learning of mathematics in most Ghanaian schools has been characterized by rote memorization and boring algebraic manipulation which resulted in pupils having low interest for this very interesting subject. Pupils who were able to do these manipulations and computation were regarded as mathematically inclined and those who were turned off by these mechanical activities were thought to be poor in mathematic. Calculators allow pupils who would be bored by these tedious manipulations to have access to real mathematics itself thus gaining a higher level of mathematics understanding, rather than giving up. One of the obvious changes was the inclusion in the JHS mathematics curriculum, introduction to the use of calculators in JHS 1 mathematics as the seventh topic. This is a well overdue change which the researcher hopes has been welcomed enthusiastically by mathematics educator. This change must be commended in two ways, with the introduction of ICT as a subject pupils need to be familiar with simple gadgets like calculators and also when pupils are introduced to calculators at JHS level, it becomes easier for Senior High School (SHS) mathematics teachers to introduce other higher functions of calculators to pupils therefore

making the transition very smooth. There is compelling research evidence that the use of calculators in instruction could impact positively both on teaches; bad pupils attitudes toward mathematics instruction and learning respectively. Adopting calculators into instruction would engage learners in their own construction of knowledge through the exploration of mathematical processes and ideas; teacher also have the opportunity to enhance their own learning of mathematics and that of others (Association of Mathematics Teacher Educators (AMTE, 2006). Considering the Ghanaian educational work force where generational differences prevail, one cannot overlook the attitudinal differences among educators in the use of calculators in the classroom irresistible invitation for an enquiry into the phenomenon, 'calculators use in the teaching and learning of mathematics and its implications on pupils performance in problem solving in mathematics'' as an area for a research study. The objectives of the current study are to investigate the feasibility of calculator use in the Ghanaian educational system. The most recent issues in the new educational reforms.(Anamuah-Mensah National Education Review Committee Report 2002) of which implementation started in September, 2007,in Ghana shows that the use of calculator motivates pupils, give confidence to those anxious about mathematics and help pupils develop fluency in number because they can give repeated practice and rapid experience of many examples. This finding of pupils developing fluency in numbers is amply supported by the eleven general objectives of the new mathematics syllabus '' use the calculators to enhance understanding of numerical computation and solve real life problem'' (Ghana Educational Service Teaching Syllabus for Core Mathematics 2007. We have come a long way from the use of slide rule to a more comfortable tool of calculators for learning mathematics. The study examines calculators use in the teaching and learning of mathematics at the JHS and its implications on pupils' performance in problem solving in mathematics. Mathematics is seen as the wheels or foundations of development of any nation. Menial task should be replaced by working smarter with the help of technology (Brumbaugh & Rock, 2001). When calculators are freely available in the mathematics class, teachers use them in a conservative way. There is no universal acceptance by teachers and administers of the role of calculators in mathematics education (Goos, Galbraith, Renshaw and Geiger, 2000). There are contradictions such as teachers who fear that pupils using calculators will lose basic computations skills (Spiker, 1991). Calculators do have a place in the primary and elementary mathematics curriculum. A thoughtful and creative use of calculators can help pupils see patterns and focus on reasoning and problem solving. Calculator use is likely to improve the attitudes of pupils towards mathematics, and increases their confidence and persistence in problem solving (Ellington, 2003). Shuard, Walsh, Goodwin, and Worcester (1991) indicated that there are pupils who do not take easily to the calculators use. They often lack manual dexterity or might have acquired the negative attitudes from their parents who are critics of calculator use at school. Hence, a school mathematics programme that integrates calculator in a meaningful way should include as well a programme that educates parents on the role of calculators in primary mathematics. They do not only need to have competent knowledge of teaching mathematic but also need to be competent in the pedagogical use of ICT (AACTE 2008; Voogt, 2008). With the introduction of calculators at JHS, one was of the view that calculators will be allowed into examination halls, but JHS pupils are still barred from using calculators for BECE. The problem still persists as JHS pupils are not allowed to use calculators even in their various schools for class exercises let alone their end of term examination. What are the perceptions of teachers towards the use of calculators in teaching and learning mathematics at the Junior High School Level? There is a missing link somewhere which must be found. In several conversations with mathematics teachers mostly at the JHS Level they iterated some of the reasons for which JHS pupils must be denied the use of calculators as; pupils will become lazy and the use of calculators will impair pupils' mathematical ability and result in increased mathematical illiteracy. Most pupils see mathematics as an abstract subject and full of symbols and lack the use of teaching and learning materials (TLMs). Calculators can be used as TLMs in mathematics lessons exciting and bring relief to pupils who are arithmophobia- the fear of numbers. It's therefore ironical if JHS pupils who are taught ICT and are not allowed using calculators. Calculators have become a common feature in our daily lives these days from the market to the most complex office. These JHS pupils use them for their homework. No wonder some of these pupils loathe mathematics at this level where the complexities of mathematics is at its lowest level and carry this attitude to the SHS level? Research shows that the use of calculator motivates pupils, give confidence to those anxious for mathematics and helps pupils develop fluency in numbers because they can give repeated practice and rapid experience 'of many examples. This finding of pupil developing fluency in numbers is amply supported by the eleventh general objective of the new mathematics syllabus'' use the calculation to understanding of numerical

computation and solve real life problems" Ghana Education Service Teaching Syllabus for Core Mathematics 2007. For instance one very important aspect of calculators is that they have an in-built structure for place value system. Young children have difficulties in learning place value and very often do not understand (Anamoah-Mensah National Education Review committee Report). Calculators have the potential of helping children generate number patterns and acquisition of skills like examination and approximation. Calculator is a tool which if used rightly can support and encourage children's mathematical thinking. Calculators do not replace the need to learn basic faces, computational procedures and algebraic multiplication skills. The use of calculators allow pupils to focus on the problem solving techniques and provides increase motivation towards the study of mathematics (Anamoah-Mensah National Education Review committee Report 2002). Calculators give room for a lot of learning experiences at various levels which mathematics more real than an abstract subject. It could be that pupils' mathematics performance at BECE could be improved tremendously when calculators are permitted into examination halls. Teachers are to provide opportunities for pupils to use them, and pupils must become proficient in their use (Anamoah-Mensah National Education Review Committee Report 2002).

Statement of the Problem

Education in Ghana has undergone a number of reforms since independence with the primary objective of improving access, quality and relevance. The major problem lies with the transition from the high school to the university. With teacher centeredness as the general mode of instruction there is enormous pressure on mathematics teachers to move faster to be able to complete school syllabi but not with much success. Appeals from the public for a one-year extension were not accepted by the president's committee on Review of Education Reforms in Ghana (MOE, 2002) but the committee recommended that, 'primary and junior secondary schools should be strengthened with the provision of qualified, committed and well-motivated teachers, learning and teaching materials and facilities, so that JSS leavers can have sound base to do the 3- year SSS program.' One notable pedagogical stipulation in the reform is that, teaching and learning is pupil centered, laying emphasis on role playing, cooperative learning, non-teaching, discovering and problem solving'. Unfortunately there was no indication of how to realize the lofty pedagogy suggested by the ministry of education. Calculators have not yet reached their full potential in mathematics instruction. Mere presence of calculators in the mathematics classroom does not guarantee their effective use during instruction. This has been attributed to many factors that range shortage of calculators and curricular materials, improper use of calculator by pupils, lack of training and in-service opportunities. Hence, there is the need to investigate teacher's perception towards the use of calculators in mathematics instruction in Junior High School. In a country where instructional practice is largely teacher-centred and the use of calculators has not been encourage beyond barely limited use, there is the need to provoke a discourse in the use of calculators and ascertain which school level in the pre-tertiary mathematics curriculum can calculators be introduced as instructional tools for instruction and learning.

Purpose of the study

The research was conducted with the aim of achieving the following objectives;

1. to examine teachers' perception towards the use of calculators in the Junior High School (J.H.S)
2. to analyze the factors that hinders the use of calculators in the Junior High School (JHS) in Ghana.
3. to explore the benefits in use of calculators in the JHS in Ghana.

Research question

The study examined calculator use in the teaching and learning of mathematics and teachers' perception towards its usage in mathematics .the study sought to get answers to the following questions:

1. What are the attitudes of Ghanaian teachers towards the use of calculators in mathematics instruction and learning?
2. What factors hinder the use of calculators in the Junior high school (JHS) in Ghana?
3. What are the perceived benefits in the use of calculators in the JHS in Ghana?

Significance of the study

Mathematics education research has indicated the positive effects the uses of calculators have on instruction and learning. Thus, there is the need to accelerate the integration of calculators into the mathematics curriculum in Ghana. Hence, calculators' integration in instruction and learning cannot be dissociated from the attitude of teachers. The findings of the study would add to the pioneering work on raise the awareness of teachers

about the importance instructional technology in general and the use of calculators in particular regarding mathematics instruction and learning (Deku, 2000).As well, the findings of the study would become a reference tool for policy marker, government and education practitioners as a whole for future policy formulation and implementation of the use of calculators in mathematics instruction and learning based on the attitudinal predisposition of Ghanaian teachers towards calculator use.

Delimitations of the study

This study would have covered all JHS in Ghana, but owing to limited time to write and financial constraints, the study was limited to only select Junior High School mathematics teachers in Bolgatanga Metropolis. These variables were considered because; they dealt directly with the teacher's perception towards calculators use in teaching and learning of mathematics at the junior high schools.

Limitation of the study

The limitation of this study warrant discussion and suggest the need for caution when interpreting the results. The findings of this study could only be generalized within the sampled school, but could not generalize for all Junior High Schools in Ghana because of the cluster sampling and simple random sampling techniques used for selecting the school and teacher respectively. Choosing the sample to be the true representative of the target population requires special skills, lot of efforts as respondents may give wrong information which will affect the validity and reliability of the information given. The statistical tool used; which involves the conversion of qualitative data into quantitative data for analysis may alter the validity of the information collected.

Definition of terms

Concepts may differ in meaning depending on the context in which they are used. It is therefore necessary to give some working definitions to the following key terms used in the study: Technology: technology as used in this study refers to a computers and their corresponding software, internet and other digital resources, handheld computing tools and their accessories and other forms of similar devices and applications (AMTE, 2006). Attitude towards mathematics: this construct is define by the emotions that a person expresses either negatively or positively towards mathematics, by the beliefs that the individual has towards mathematics, and by how he. She behaves the subject (Hart, 1989)

REVIEW OF RELATED LITERATURE

Extensive discussion of studies on teachers 'attitudes towards the use of calculators in mathematics instruction and how they affect student learning were captured. The attitude towards calculators use was also considered within the large context of technology integration in teaching to better understanding why in spite of the enormous investment in the area of educational technology, real barriers pose considerable threat towards technology integration in mathematics instruction and learning. The literature research was based on the following headings: benefits in the use of calculators, factors that hinder calculator use and teachers' perception towards calculator use.

Benefits of the use of calculator

Calculating machines have existed for thousands of years, beginning with the abacus in ancient Babylon (Gunstein & Lipsey,2001) .Historically, teaching and learning of mathematics in most Ghanaian schools had been characterized by rote memorization and boring teacher centered approaches which resulted in pupils having low appetite for this very interesting subject. Since 1980s; to the present ,the educational reforms on elementary in Ghana have been geared towards the adopting of the United States kindergarten to secondary level system but the use of calculators in instruction has not taken off yet in Ghana despite its importance on the academic achievement on the learners. With the use of calculators in mathematics instructions, a lot of learning experiences at various levels which makes mathematics look more real than an abstract subject could be achieved .it could be that pupils' mathematics performance at BECE could be improve tremendously when calculators are permitted into examination halls. There is compelling research evidence that the use of calculators in instruction could impact positively both on teachers' and pupils' attitudes towards mathematics instruction and learning respectively. Adopting calculators into institution would engage learners in their own construction of knowledge through the exploration of mathematically processes and ideas; teachers also have the opportunity to enhance their learning of mathematics that of others (The Association of Mathematics Teacher Educators, AMTE, 2006). Nikolaou (2001) conducted a meta-analysis to synthesize and extract the major findings of individual original studies on the effects of the use of hand-held

calculators on mathematics achievement and problem-solving abilities of elementary, middle, and high school pupils. The review points to the fact that in totality a very strong case has been made for the application of calculators in the mathematics teaching and learning. Introducing innovation in teaching requires that the teachers involved demonstrate positive attitude towards the innovation because play a crucial role in technology integration into instruction. Most often pupils who use calculators rather than paper-and –pencil for most of their class work score higher on their test than their non-calculator counterparts. Technology is one of the principles of the NCTM (2000) standards; and this principle has indicated the importance of instructional technology in a variety of ways bringing into focus how best technological tool can aid mathematics instruction.

A meta-analysis of 42 studies of student's access to graphing calculators revealed mixed results (Ellington, 2006). When pupils were taught daily instruction with a calculator and were able to use a calculator on assessment, pupils had higher scores 60% more often than pupils without the technology. However, pupils that used calculators in class, but not no test, did not show any greater knowledge or achievement. But, they still had a greater mathematical understanding. The analysis also revealed that pupils using calculators had a 58% better attitude towards mathematics (Ellington, 2006). The attitudes of teachers were not analyzed but the studies gave support for teachers to continue teaching and assessing pupils with this technology. A study by Chamblee, Slough & Wunsch, (2008) enrolled 22 high school mathematics and science teachers in a professional development programme for one year that focused on training teachers to incorporate graphing calculators into their curriculum. Collecting, representing and analyzing data were the main skills focused upon. Researchers assessed the concerns of the teachers at the beginning and end of the school year. The study reported that the teachers' knowledge of the graphing calculators, exploration of the technology and implementation had all increased at the end of the training year. Findings from Vanderbilt University study showed that pupils with a basic knowledge of mathematical facts benefited from the use of a calculator than those without the knowledge ('Calculators OK in Mathematics',2008). For pupils who already had a basic knowledge of multiplication, using a calculator did have an impact to them. But for those who did not have good multiplication skills, the calculator hampered their performance. Confirming the results of other studies, pupils benefited from the calculators by being able to check their answers and practicing more. When evaluating pupils the study concluded that is important for pupils to first learn how to compute. Only then teachers should readily embrace using technology (Calculators Ok in Mathematics). The calculator was placed in a separate unit where pupils used them to make big calculations or to check their answers. However, the National Council of Teachers of Mathematics (NCTM, 1989, 2000) in the United States revised their original curriculum standards, and claimed that the calculator must now be incorporated into the curriculum standers, and claimed that the calculator must now be incorporated into the curriculum of primary school schools. In 2007, the Ministry of Education in Singapore also announced their plans to incorporate calculators into their educational policies of mathematics. When they explained the benefits of using the calculator when learning math, the calculator become a hot discussion topic by the public, which allowed the government to push for actual implementations and practical change to the teaching of mathematics (Ministry of Education, 2007). Therefore, the integration of the calculator into math courses in international education is now a growing trend. Technology is one of the principles of the NCTM (2000) standards; and this principle has indicated the importance of instructional technology in a variety of this ways bringing into focus how best technological tools can aid mathematics instruction. Niess (2006) has about calculators,' they appear to be tools for adults to use as they wish but not for children to use in learning mathematics'' (p.198).Furthermore, the important task to be addressed by educators would be helping learners to think while their calculators assist in their thought processes but not a situation where learners refuse to when using calculators. Teachers could achieve this objective if they have right predisposition to technology integration and for that matter the appropriate use of calculators in mathematics instruction and learning (Niess, 2006).

Factors that Hinder Calculator Use

Niess (2006) has this to say about calculators, they appear to be tools for adults to use as they wish but not for children to use in learning mathematics''. Furthermore, the important task to be addressed by educators would be helping learners refuse to think when calculators. Teachers could achieve this objective if appropriate use of calculators in mathematics instruction and learning (Niess, 2006). Research shows that the use of the calculator has remained relatively low. For example, results of a sample survey conducted on fourth graders in the U.S show that 37% of the pupils rarely or never used calculators in their studies (Groups et al.,2004).This survey further explained

that one of the main reasons for the low use of calculators is due to the teachers' beliefs (Albion and Ertmer, 2002; Brinkerhoff, 2006). Although there has been related research on this topic in other countries, there has been none in Taiwan. These studies have been supported by related contributions by practitioner educators (Demana and Waits, 2000; Edwards, 1996; EMBSE, 1997). Whoever, calculators can be used as intervention or anxiety reduction technique compared to other units, calculator appears more in sections on numbers and quantity (Miller, 2003). The teachers also admitted that it does not matter whether the calculator facilitates or hinders the pupils' learning; a teacher's belief towards the calculator is the determining factor, along with the teacher's own educating level on the amount of calculator use. Shulman (1986) takes a look at what future teachers need to do to change by using teaching methods which provide easy access to mathematics knowledge for learners, and envisages a comprehensive knowledge structure developed by teachers about mathematics as a subject, the pupils, instruction, and curriculum in what Niess (2006) has termed technology pedagogical content knowledge (TPCK). Other studies have also shown more support for the development of TPCK in student teaching practices and the importance of applying it through various coursework in instruction and learning (Margerum-Leys and Marx, 2002; Pierson, 2001; Zhao, 2003). Technology is one of the principles of the NCTM (2000) standards; and this principle has indicated the importance of instructional technology in a variety of ways bringing into focus how best technological tools can aid mathematics instruction. Niess (2006) has this to say about calculators, 'they appear to be tools for adults to use as they wish but not for children to use in learning mathematics''. Furthermore, the important assist in their thought processes but not a situation where learners refuse to think when using calculators. Teachers could achieve this objective if they have the right predisposition to technology integration and for that matter the appropriate use of calculators in mathematics instruction and learning (Niess, 2006). In their investigation, Norton, McRobbie, and Cooper (2000) concluded that teachers' resistance to technology use could be associated with their beliefs about the mathematics learning and their teaching practices. Some teachers' discomfort with the use of technology and the absence of success cases to learn from could also explain their negative tendencies towards technology use (Norton, McRobbie, and Cooper, 2000). Putnam and Borko (2000) question whether teachers are ready to engage in technology-based instructional practices in mathematics learning. Whatever the challenges, teaches could still make the effort utilizing the experiences they might have acquired in their training. Norton, McRobbie, and Cooper (2000) argue that taking the first step to overcome beliefs could be rather difficult in that beliefs are not only the toughest factor but also significant obstacle to effecting pedagogical changes in mathematics instructions. Niess (2006) has advocated for continued research into real barriers in order to come up with remedies when preparing teachers and planning professional development programs. The task of knowing how pupils learn and coming up with the curriculum 42 that assists pupils in learning mathematics with technology could also constitute a barrier to technology use (Niess, 2006). In a related perspective, some educators are quite apprehensive about the benefits of technology in instruction and learning to the extent that teachers come under considerable tension when it comes to staying current with the ever changing technology in mathematics instruction (Cuban, 1999; Zhao, Pugh, Sheldon, and Byers, 2002). Many other have delved teachers' adeptness in, and their attitudes toward the use of technology. These studies have also concluded that, teachers who have low inclination towards technology, and would not want to spend time to learn how to use technological devices are not very likely to incorporate technology in their teaching (Sandholtz, Ringstaff, and Dwyer, 1997; Becker, 2000).

Teachers' Perception towards Calculator Use

According to research, the major factor which influences student learning is the teacher (Roueche and Roueche, 1995; NCTM, 2000).The teacher must have positive attitudes both towards mathematics and the use of resources such as calculators to make mathematics fun and meaningful to pupils. Teachers need to have favorable attitudes towards relevant developments in educational technology to be able to impact positively on the pupils they teach (Cornell, 1999; Schwartz, 2000).In the light of the critical role attitudes play in mathematics learning, much effort has been devoted to find the variables which could work towards developing positive attitudes toward mathematics learning. Minister of Education (MOE 2000) suggested that teachers should start every lesson with a practical problem to help pupils acquire the habit of analytical thinking and the ability to apply knowledge in solving practical problems and also make use of the calculator and the computer for problems solving and investigations of real of life situations (MOESS 2007), but this orientation to teaching and learning requires more than recommendations contained in syllabuses. Furthermore, studies have revealed the improvement pupils' attitudes

undergo through the use of graphing calculators in mathematics instruction (Acelajado, 2001; Almeqdadi, 1997; Devantier, 1992; Rodil, 2000; Schultz, 1994).These studies have been supported by related contributions by practitioner educators (Demana and Waits, 2000; Edwards, 1996, Embse, 1997). According to Stigler and Hiebert (2000), teaching is embodied in a culture; and for that matter Ghanaian teachers teach the way they were taught. From their experience, the present generation of teachers would embrace or identity with the idea of paper and pencil computational rigor as a necessary training for mental mathematics discipline. These teachers would generally agree with the view that paper and pencil computation correlates positively with higher mathematics achievement. (Gelernter, 1988; Klein, 1998; Loveless, 1997). Training was divided into nine parts that included pedagogical ideas, specific skills, linear functions, graphical representations, polygons, and transformations. 569 pupils were involved in the study' 360 were taught by teachers trained for this study and 209 pupils were taught by teachers without this specific training. The study found that pupils who were taught by these. Cedarville University School of Graduate studies, 45 trained teachers made greater increase on the Florida comprehensive assessment test, even though they were not permitted to use a calculator. The researchers concluded that the training workshops that 10 of the teachers attended were an effective way to help raise test scores for pupils (Luamarkis & Herman, 2008). The failure of the education reform policy is often attributed to the difference between the belief of the teachers and the education policies. For teachers to change their teaching methods usually requires self-intuition. They need to first become personally aware of the new tools and concepts in order for them to accept and execute the changes (Dale & Trish, 2001).In other words, since the teachers have the ultimate say in their in their teaching methods and supporting materials, whether or not the calculator will be incorporated as a learning tool is entirely depend on the teachers' beliefs. In recent years, some reaserch has been done on the use of the calculator in math education as well as related studies on the beliefs of the teachers pertaining to the use of the calculator. For example, there was a poll (Yeo, 2008) that surveyed the leaders of the mathematics department in 43 primary schools in Singapore. Results show that the leaders believe the calculator is beneficial to beginner level mathematics, and they also agree that pupils have a better understanding of math and find it more entertaining when using the calculator. In addition, their self-described beliefs, knowledge and teaching experience all match the factors mentioned in the ministry of education in Singapore's 2007 statement on the use of calculators for the fifth and sixth grade in primary school. Adabor, (2008) surveyed 179 primary and high school math teachers in Ghana, and discovered that the majority (84%) of the teachers surveyed believe that pupils should learn how to use the calculator. Eighty percent (80%) of these teachers also feel that before allowing the pupils to sue calculators, the pupils need to first grasp the basic concept and logic of mathematics. Furthermore, in response to these suggestions made by NCTM, a researcher conducted a study on primary school teacher and discovered that in the region researcher, the majority of the mathematics teacher uses the calculators 6.6% more time than average. Compared to other units, the calculator appears more in sections on numbers and quantity (Miller, 2003). Simon (1990) conducted a study to determine the extent to which lack of the use of calculators in the elementary school classrooms could be attributed to the mathematics anxiety of the teachers involved 98 teachers from communities in southern California participated in the study under the administration of the mathematics anxiety.

Rating scale (MARS) and survey on calculator usage (SOCU).using regression analyses and the spearman rank correlation, the study reaches the following significant results except the hypothesis which related district support of calculator use:

1. The non-use of calculators among elementary school teachers was found to be positively related to the teachers' mathematics anxiety.
2. The non-use of calculators among elementary school teachers also showed positive relationship with teachers' attitude toward the use of calculators in the classroom.
3. The personal use of calculators among elementary school teachers was negatively related to their mathematical anxiety.

Wu, An, and Wang (2005) compared mathematics teachers confidence in integrating technology in the united states and china. One hundred and twenty-five elementary mathematics teachers,48 from southern California in the United States and 77 from Southern Jiansu in China, constituted the sample. The Chinese teachers taught from first to sixth levels mostly mathematics only. The Unites States teachers taught from kindergarten through sixth grade and they were also involved in multiple 31 subject assignments. The categories of teachers in the sample had teaching

experience from one to 30 years. A survey of 25 questions based on teachers' beliefs and confidence and knowledge in integrating technology in teaching was conducted on the 125 elementary mathematics teachers in both the United States and China. Wu, An and Wang (2005) used quantitative methods employing test and person correlation test results indicated that there were significant differences in teachers knowledge about using technology in instruction among the two groups of teachers, and teachers knowledge had considerable influence on their confidence in using technology. From the results, Chinese had stronger confidence in using technology. Higher level of confidence was associated with fewer years of teaching experience among the Chinese teachers. Similarly the lower grade teachers tend to have more confidence. The confidence in using calculators in the United States was different. Wu, An, and Wang (2005) found also that in the United States, the higher the grade level the teachers taught, the more confident they were in using the calculators. That is, the lower grade level the less the teachers used the calculators. From the results, the Chinese demonstrated more knowledge and skills in using technology. Another framework developed by Myhre, Popejoy, and Carmey (2005) is the model, new outcomes; learning in mathematics integrating technology (NO LIMIT) 44 which captures relatively, the cognitive, behavioral and the effective dimensions of technology integration in instruction. The model spells out the various process of teachers' progression in technology use in the following stages; identification of preconceived perceptions about technology in instruction; clarification of the impact on the teacher's own practice; acceptance of own practice' exploration of innovation and new practices' understanding and ability to alternate between new and existing approaches to teaching and ability to implement and the appropriate decisions about when to use technology (Myhre, Popejoy & Carmey, 2005). They outlined six chronological stages for teachers who joined (NO LIMIT) either not prepared, somewhat prepared or very much able to use technology. Some teachers claim the use of calculators would even harm pupils' achievement in mathematics. Such teachers would not dispute the claim that the use of paper and pencil in solving problems benefit pupils more than the use of calculators in similar problem solving tasks. Myhre, Popejoy & Carmey indicate that teachers in stage two would be eager about the use of technology yet uncertain if technology adoption would be useful in practice. Technology use found to be problematic at this stage might accentuate teachers' aversion to the innovation being introduction; otherwise there would be a smooth transition to the next stage. Myhre, Popejoy & Carmey point out that self-awareness is the hallmark of stage three. That is, teachers at this stage take dispassionate stock of their classroom activities, bringing the whole instructional exercise under close scrutiny and assessing their close relationship with their pupils. As a result, teachers would be in the better position to make the right chooses with regard to the technology suitable for their situation. Myhre Popejoy, and Carney (2005) content that 45 beyond stage three, teachers could adapt technology to existing practice. This would lead to skill development on the part of the teachers and as a result of, confidence building in their ability to adopt technology in math instrument would have and a major boost. Teachers at stage four for this model would take instruction beyond their traditional teaching practice, and consider alternative mathematic method that might use technologies to support pupils' knowledge construction and learning. Myhre Popejoy, and Carney (2005) conclude that the fifth and the sixth are considered logical sequence of the fourth stage. The teachers would now feel at ease and comfortable in interchanging technology and also make a final determination of the effect s of the various method within their corresponding contexts, as a results of the explicit transformation from the traditional behaviour instructional practice. Hence teachers attitude towards technology use according to this model would depend on their prior professional engagement with technology (Myhre Popejoy , and Carney 2005). The review points to the fact that in totality a very strong support was made for the use of calculators in the mathematic teaching and learning. Introduction innovations in teaching required that the teachers involved demonstrated positive perception towards the innovation because teachers play a crucial role in technology integration into instruction. Secondary school teacher are more likely to welcome the use of any form of calculators if they offered considerable help (Kissane, 1995). No doubt, the use calculator in mathematics instruction and learning has provoked intellectual debate, and according to Ralston (2004) some educators might tend to assume an inconclusive process regarding the effects of using calculator in mathematics instruction and learning, however, many students tend to support the position that calculator use does not inhibit the learning of traditional mathematics but rather enhance it. Some of the earlier researchers on attitude towards mathematics and its teaching and learning include; Eshun, (1999,2000); Caswell, (1996); Fennema & Sharman , (1989) ; Betz (1978); Aiken, (1974) Taylor (1971) Aiken and Dreger, (1961) and Carey (1958) most of the literature revolves around Primary and Senior Secondary School. There was no much to find

under perception of teachers towards calculator usage at junior high school level. The research on teacher's perception towards calculator usage was mainly restricted to secondary and higher education level. Several of the research done was carried on in different countries other than Ghana. Most of the literature revolves around primary and senior secondary school. This research would however investigate into the perception of junior high school teachers towards calculator usage in Ghana

METHODOLOGY: This study investigates into Ghanaian Junior High School mathematics teachers' perception towards the use of calculators in mathematics instruction and learning by employing quantitative and quantitative methods. The methodology addressed the research design; the population and sample; instruments used in the study, the data collection procedures, and the data analysis.

RESEARCH DESIGN: The researcher employed both qualitative and qualitative research methods. The study used closed – ended questionnaire as the main instrument to collect data which were quantified into values for interpretation and qualitative research method were used in collecting, interpreting and analysis the data because according to Knupfer and McLellan (2001) description research does not fit neatly into the definition of either quantitative research methodology but it can utilize element of both often within the same study. This study, reported summary data such as measures of central tendency (mean), the spread of responses (Standard deviation), Percentage and bar graph. Hence, it fits into a descriptive survey design, survey research commonly includes that type of measurement, but often goes beyond the descriptive statistics in order to draw inferences. Descriptive studies can yield rich data the lead to important recommendations.

POPULATION: The population included all basic school teachers in Ghanaian. The target population was all elementary teachers and pupils in Upper East Region in Ghana and the accessible population was all JHS teachers and pupils in Bolgatanga Metropolis.

SAMPLE AND SAMPLING PROCEDURES: Bolgatanga Metropolis was selected because it is one of the cosmopolitan cities in Ghana. Stratified sampling technique was used in selecting the sample. To facilitate comparison across level, the researcher used a sample of 50 basic school teachers. The complete lists of basic school in Bolgatanga were obtained at the Regional Education Office. Ten Basic Schools within the Bolgatanga Metropolis were selected for the study. Simple random sampling was then used to select 5 professional mathematics teachers from each of the chosen schools.

INSTRUMENT: The researcher collected data by administering a questionnaire. Part one of the questionnaire requested for the background information on the responded. In part two of the questionnaire, teachers were given 20 questions which were divided into 3 sections.

DATA COLLECTION: Secondary data was collected to augment the study. The questionnaires were administered to all the teachers in the JHS and were supervise by the researcher. The completed questionnaires were collected from the teachers and were analyzed based on teachers perception.

DATA ANALYSIS: This study used a mix – method (both qualitative and quantitative) to analysis data. Knupfer and McLellan (2001) remarked that, any measured quality has just the magnitude expressed in its measure and quantities are of quantities. According to an International Program for Development, Evaluation and Training – 2007 whether you choose qualitative data or quantitative data, you will find that your data collection and data analysis will overlap. Tesch, cited in Fara Jr., Brown, and mangione (2002), also indicated that, 'a process of data analysis is electic; there is no 'right way''. Creswell cited in Fara Jr., et al. (2002), also noted that, ''unquestionably, there is no single way to analyze qualitative data – it is an eclectic process in which you try to make sense the information. Thus, the approaches to data analysis espoused by qualitative writers varied considerably''. The study was interested in describing teachers' perception towards the use of calculates in teaching and learning mathematics. Descriptive statistics such as tabulation, mean, standard deviations and percentages were used to make inferences and statements to describe the finding. In analysis research questions two, six items were considered. The items were scale under four subscales: knowledge and skills, anxiety, time factor and access. Items 13, 14 and 15 were scaled knowledge and skills. Items 16 was also scaled under anxiety, item 17 was scale under time factor whereas items 18 was scale under access. The completed questionnaires were collected and the statistical package for social science (SPSS) software package was used to analysis the data gathered. The data gathered was coded and the results was analyzed under each variable in section A of part two of the questionnaire in section B of the questionnaire, variable were grouped under subscale and were analyzed. Both descriptive and inferential statistics was used.

RESULTS AND DISCUSSION: The study addressed the research question.

1. What are the attitudes of Ghanaian teachers towards the use of calculators in mathematics instruction and learning?
2. What factors hinder the use of calculators in junior high school (JHS) in Ghana?
3. What are the perceived benefits in the use of calculator in the JHS in Ghana

ATTITUDE OF TEACHERS TOWARDS THE USE OF CALCULATORS

In analysis teacher attitude towards the use of calculators, twelve items were considered. The items form section A of part two of the questionnaire. For all the twelve items, a five points Likert scale (1 = strongly disagree, 5 = strongly agree) was used. The scores were interpreted as follows: 1 is the lowest possible score which represent a very strong negative attitude. Research of some items was done so as to get valid and reliable results. Table 1 show the mean and standard deviation of the attitude of teachers towards the calculators

The overall attitude of teachers (mean = 4.26) seemed to suggest high positive attitude towards the use of calculator. Form table 1, it could be seem that most teachers advocate for calculators to be used as good supplement to teaching and learning (mean = 4.93). From table 1, the standard deviation is round 1.013 which indicates that the variable measured were closely spread around the mean and the responses did not differ much.

Factors That Hinder Use Of Calculators In an attempt to analysis the factor that hinder the use calculator, six items were put into four subscale: knowledge and skills (information about calculator and the ability to sue them) , anxiety (fear to used and talk about calculator usage), time factors (time need in using calculator during instruction), access (the availability of calculators). A five point likert scale (1 = strongly disagree, 5 = strongly agree) was used. The scores were interpreted as follows: 1 is the lowest possible score which represent a strong negative attitude, while the 5 is the highest possible score which represent a very strong positive attitude. Rescaling of some items was done so that a high score on calculator usage could be interpreted as negative attitude towards calculator usage. Table 2 shows an overview of factor that hinder the use of calculator, which their respective means and standard deviation.

Table 1: Attitude of Teachers towards the Use of Calculators in Mathematics Instruments and Learning

Items	Mean	Standard Deviation
1. Calculators are too complicated to be used in teaching	4.88	1.294
2. I am not prepare to integrate calculator usage in teaching	4.80	1.093
3. I won't have anything to do with calculator in teaching	4.82	1.071
4. I teacher better without using calculator	2.70	1.074
5. I am not the type to do well with calculator as a teaching	3.68	1.273
6. Calculator makes me more efficient when I am teaching	2.92	1.038
7. Calculator are difficult to use in lesson delivery	4.90	1.065
8. I generally have positive attitude towards calculation	4.88	1.308
9. Calculator usage makes course more interesting	3.75	1.126
10. Calculator can be good supplement to support teaching	4.93	0.931
11. Calculator will make pupils think less in mathematics	4.89	1.212
12. I am not the type to do well with calculator usage	3.95	1.178
Overall mean	**4.26**	**1.013**

Table 2: Factor That Hinder the Use of Calculators

Subscale	Mean	Standard
Knowledge and skills	4.30	0.785
Anxiety	3.95	1.021
Time factor	3.02	0.469
Access	4.05	1.041

From table 2 above, it could be seen that factors that hinder calculator usage and knowledge and skill, anxiety, time factor and access to calculators. Knowledge and skill (mean = 4.30). From seemed to be the major factor that hinder calculator usage. The next most important factor that hinder calculator usage after knowledge and skills is access to calculators (mean = 4.05). From table 2, the standard deviations of the four respective subscales are relatively low which indicates that's the variable measure were closely clustered around the mean and most of the responses were

closely relate. This gives clear evidence that knowledge and skills, anxiety, time factor and access are the major factors that hinder the use of calculator.

Perceived Benefits in the Use of Calculator: Under section C of the questionnaire, respondents were asked whether calculator would be beneficial in teaching and learning of mathematics in item 19. Item 20 however required of the respondents to give reasons for their choice of answer in item 19. Most of the respondents supported that calculators would be beneficial when integrated in mathematics instruction. Usefulness of calculators in teaching and learning of mathematics. From figure 1 above, thirty – four of the respondents representing 68% said that calculator would be useful in teaching and learning of mathematics, seven of the respondents representing 14% were uncertain about the usefulness of calculator in mathematics instruction. However, four of the respondents representing 8% said that calculator could not be useful in mathematics instruction. This showed that majority of the respondents were in support that calculator would be useful in teaching and learning of mathematics. In respond to the item 19 on the questionnaire, the respondents that supported that calculator would be useful in teaching and learning gave the following reasons in respond to item 20 on the questionnaire. Table 3 below shows the reasons given by respondents who agreed that calculators are useful in teaching and learning of mathematics.

Table 3: Reasons for Calculator Usage In Teaching And Learning

Usefulness Of Calculator	**%**
Motivation	10
Development of number sense	12
Development of connections, relations and patterns	20
Technological knowledge	14
Respond nation standard	6
Mathematics application	6

From table 3 above, ten percent of the respondent argued that calculators' motivation students to acquire numeracy skills, twelve percent of the respondent pointed out that calculator aid pupils to develop number sense, twenty percent of the respondents argued that calculator help children develop mathematics ideas and understand connections, relations and patterns, fourteen percent of the respondents were of the view that calculator acquire children with technology, six percent of the respondents were of the view that calculator usage that enable pupils responds to national standard and six percent of the teachers also stated that calculator would help pupils to appreciate the realities of mathematics and its applications. t responds to the item 19 on the questionnaire, the respondents that supported that calculators would not be useful in teaching and learning gave the following reasons in respond to item 20 on the questionnaire. Table 4 below shows the reasons given by respondents who disagree that calculator are useful in teaching and learning mathematics.

Table 4: Calculators Are Not Useful In Mathematics Instruction and Learning

Calculators are not useful in instruction	%
Hinder development of basic skills	2
Hinder development of metal computational skills	2
Discourage development of thinking skills	2
Calculators arte not affordable	2

From table 4 above, two percent of the respondents were of the view that calculator use hinders the development of basic arithmetic concept and skills especially among the low ability pupils. Again another 2% of the respondents pointed out that calculator use hinder the development of mental computational skills. Two percent of the teachers argued that calculator use does not promote the development of thinking skills and the final 2% also were the view that not all pupils can afford calculators. However, fourteen percent of the respondents were uncertain about the usage of calculators in teaching and learning of mathematics.

Key Finding The research revealed four major finding. First, most teachers have positive attitude towards calculator usage in mathematics instruction. Second, most teachers lack skills, competence and confidence in using calculator in mathematics lessons. In addition, majority of them agree that calculator will be beneficial in mathematics instructions and most of teachers willing to integrate the use of calculator in their lessons.

Conclusion and Recommendation

Conclusion

The results from the analysis of the data showed that teachers generally have positive attitude towards the use of calculator in teaching and learning of mathematics at the Junior High School in Ghana. The results from the analysis of the data showed that factors that hinder the use of calculator at the JHS in Ghana include; lack of calculator know how, lack of competence in using calculator, lack of skills in the use of calculators, teacher's phobia in calculators usage, time factor as well as lack of confident in calculator usage. Finally, from the analysis of the data, calculator would be beneficial when integrated in mathematics instruction in Junior High Schools in Ghana.

Recommendation for Policy and Practice

Based on the finding of the study, the following were recommended;

1. The study should be replicated in other regions of Ghana and in large number of institution to have a national reflection of teachers' attitude towards the use of calculator in mathematics instruction and learning.
2. The study should be pursued over an extended period to have better participation of teachers. The shortcoming of the current research in terms of their participation compromised by teachers' professional assignment should guide future replication of this study.
3. Prior to the effecting the integration of calculator use in instruction and learning future workers hop on ICT should have resource persons address specifically current development in calculator use in mathematics instruction and learning
4. The discourse emerging from the conclusion of the study should engage the attention of education association such as Mathematics Association of Ghana (MAG) and Ghana Association of Science Teachers (GAST).
5. Government should make calculators available to pupils.

Suggestion for Further Research

The present study examined the perception of teachers towards calculator usage in Junior High School in Bolgatanga Metropolis. Further study could be carried out in this area while extending to wider population. The study investigated some factors that hinder the use of calculator in junior high schools. Further studies could be conducted examining other factor such as the relationship between gender, background of teachers among others and the attitude towards calculator usage. Finally, further studies could be conducted to find out the perception of pupils towards the use of calculators in instructions.

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