Attitude of Secondary School Students on use of Scientific Calculators in Learning Mathematics in Embu District in Kenya

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Abstract

Mathematics plays a crucial role in technological development of any country, attainment in the subject determines the rate of adoption of appropriate technology and industrialization. In Kenya mathematics is compulsory in primary and at secondary school level. Use of scientific calculators was introduced in Kenya secondary schools in the year 2005. However its influence on students' attitude towards mathematics has not been established. The purpose of the study was to investigate the influence of using scientific calculators in teaching mathematics on students' attitude towards mathematics in secondary schools in Embu District. The study sought to determine whether there was a difference in attitude towards mathematics when students used calculators. The study employed the descriptive survey research design. The research was carried out in nine secondary schools in Embu District in Eastern province in Kenya. The subjects were form three students and stratified random sampling technique was used to draw the participating schools. The sample size was 370 students. The research instrument used was Attitude Questionnaire for students and a teachers' Questionnaire. The reliability coefficient of at least 0.7 was used in the study to test the degree of internal consistency of research instrument. The raw data obtained were scored, coded and analysed using both descriptive and inferential statistics involving chi-square. The hypothesis was tested at alpha =0.05 level of significance. From the study there was evidence that use of calculators influence student attitude towards mathematics. The findings of this study are helpful to curriculum developers in meaningful integration and incorporation of calculators into the curriculum to improve the attitude towards mathematics.

Keywords: Attitude, Learning & Scientific Calculator

Background of the study

Mathematics is seen by society as the wheels or foundation of scientific and technological knowledge that is vital in socio-economic development of any nation. There is a general agreement in any society that every child should study mathematics at school to acquire skills for adult life (Orton& Wain,1996). Great changes have taken place in mathematics curriculum throughout the world due to the realization that mathematics is a practical subject. There are many countries in the world, where great concern is frequently expressed about attainment in mathematics because it is regarded as important and children are expected to demonstrate a high level of competence in the subject. Due to its significance, there is greater pressure for children to succeed in mathematics more than in any other subject (Fraser &Gilan, 1992).

According to Eshiwani (1993) some of the major objectives of mathematics education in Kenya are the development of thinking ability and logical thought. Mathematics aims at developing numerate and rational citizens, useful in the home, society and nation. Due to its importance and use in the learning of other subjects and its application in industry and real life situations, mathematics is compulsory for all students in Kenya. As such, students performance in mathematics is of great concern to education stakeholders (KNEC, 2001). Mathematics is used at the university as a filter of students into science and related careers (Eshiwani,1984). Thus mathematics is used as a basic entry requirement into any of the prestigious courses such as medicine, architecture and engineering among other degree programmes. Despite the important role that mathematics plays in society there has always been poor performance in the subject in national examinations.

Mathematics is a crucial skill in the information age. The achievement in mathematics must be improved to maintain the economic leadership. While technology advances at high speed, a poor mathematics performance in schools shortchanges the students future and endangers the prosperity and nation's security. In the era of fast technological advancement, keeping up with the latest innovations and inventions that technology can offer is essential in order to be relevant now and in future (Noraini, 2006). According to Pomerantz (1997), mathematics has grown substantially in the last fifty years, and the tools available to aid mathematics learning by students have changed dramatically. Calculators are powerful learning tool that allow students to experience the richness and value of mathematics by greatly reducing the need to execute paper-and-pencil computations and algebraic manipulations. The calculator is rapidly becoming an accepted and often preferred mode of computation in everyday life and business at all levels. Implementing calculators in mathematics curricula will allow student to learn more quickly and efficiently while keeping them engaged in what they are learning. By reducing the emphasis on learning computational algorithms, more time will be available to spend on sharpening problem-solving, mental arithmetic, estimation skills and more applications can be considered hence the students who were previously turned off by tedious computations may now be more inspired to explore the richness of mathematics.

Educators in many countries do not believe that the calculator is appropriate for students for they see the dangers such as regular use will result in weakening of basic facts and paper-and-pencil algorithm for computation, use at early age may hinder development of number concept, students will become calculator dependant, student will become more likely to accept incorrect answers from the calculator and if students use the calculator they will not learn to think (Suydam, 1980). According to Torstein and Neville (1985) there is need to help dispel the calculator myths such as calculator use does not require thinking, use of calculator will harm students mathematics achievement, computations with calculators are always faster and calculators are useful only for computation. This will be done by demonstrating that calculators do not think for themselves, not all problems can be solved with a calculator and it is sometimes faster to compute mentally. The District Education Officer of Embu when releasing the KCSE results analysis for 2003 noted that mathematics continued to register a dismal performance and it was of great concern that 875 candidates scored a mean grade of E which was an increase of 0.96% over the previous year. He also noted that mathematics is a core subject and poor performance needs to be fully addressed. Thus the need to study the influence of using scientific calculators in teaching mathematics on students' attitude in secondary schools.

Statement of the problem

Achievement in mathematics has been poor over the years. This has been attributed to many factors that have ranged from lack of textbooks, poor teaching methods, inadequate teaching- learning resource materials, student inability to relate and organize material in the time allowed to an acute shortage of trained personnel in mathematics teaching. Another contributing factor to poor performance is lack of materials for numeration and computation. New materials and devices of instruction are being developed, never before available in schools and recently there has been revolution of technological advancement like use of calculator in teaching and learning of mathematics in secondary schools. However, the influence of using the calculator in improving students' attitude towards mathematics has not been investigated. Hence the study investigated the influence of using scientific calculators in teaching mathematics on students' attitude towards mathematics in secondary schools in Embu district. The following objective guided the study:- To determine the influence of use of calculators on form three students' attitude towards learning mathematics. The hypothesis of the study was:- There is no significant relationship between use of calculators and attitude towards mathematics by form three students in Embu district.

Methodology

The study adopted a descriptive survey design as it is concerned with the conditions or relationships that exist. In this study, subjects who have been exposed to a stimulus (use of calculator) were studied and the stimulus might have started much earlier on some groups. The independent variable (use of calculator) in the study had already occurred and the researcher started with the observations of dependent variable (attitude towards mathematics) to see their relationships. The target population was form three students in secondary schools in Embu district. There were 3028 form three students in Embu district. Stratified random sampling technique was used to draw the participating schools for it ensures inclusion in the sample of subgroups which otherwise would be omitted entirely by other small numbers in population. The criterion used for stratification was gender in that there were three categories namely boys', girls' and mixed secondary schools. For each category simple random sampling was done to select schools that were used for the study.

Incase the school selected had more than one stream, the streams were randomly assigned using simple random method to ensure that each stream had an equal chance of being included in the sample. The actual sample size used in the study was 370 students from the nine schools that were randomly selected. The subjects were used in their intact classes. The instrument used was questionnaire, one for students and another one for teachers. The pilot study was conducted before the actual data collection in two schools in another district to ascertain the reliability of the instrument. The reliability of Attitude questionnaire was tested using Cronbach's correlation coefficient Alpha formula, which was considered appropriate where the items are of varying point values or attitude scales and also determines reliability of an instrument by a single administration. The degree of internal consistency as estimated by Cronbach Alpha value obtained was 0.73 for Attitude Questionnaire for students and was considered reliable. The Attitude Questionnaire was administered to the students by their teachers while the researcher administered the questionnaire to the mathematics teachers of participating schools. Data analysis was done both quantitatively and qualitatively. The results were tabulated and summarized in graphs and tables.

Results and Discussion

This section presents the research findings in line with objective that guided the study. A total of 370 form three students from nine secondary schools responded to the attitude questionnaire. Out of these 41% were girls while 59% were boys. The teachers that participated were 20 mathematics teachers in the sampled schools. The hypothesis sought to check if there was any significant relationship between use of calculators and attitude towards mathematics. The independent variable was use of calculator and the dependent variable was attitude towards mathematics. The sampled students and teachers were given the questionnaire to fill in their views. The responses given were used by the researcher to obtain information on students attitude. The responses were then categorized into various groups based on similarity and relevance to the question.

Availability and use of calculators by students

The researcher sought to find out whether the students had the calculators and how frequently they used them during computations and examinations. Fifty eight percent of the students always have the calculators, 31% sometimes have and 11% never have the calculator. A total of 89% of the students said at least the calculator is available to them. This implies that the calculator is available to almost all the students since it is a small percentage that never have. When the teachers were asked whether the students always had the calculator, the responses are indicated in Figure 1.

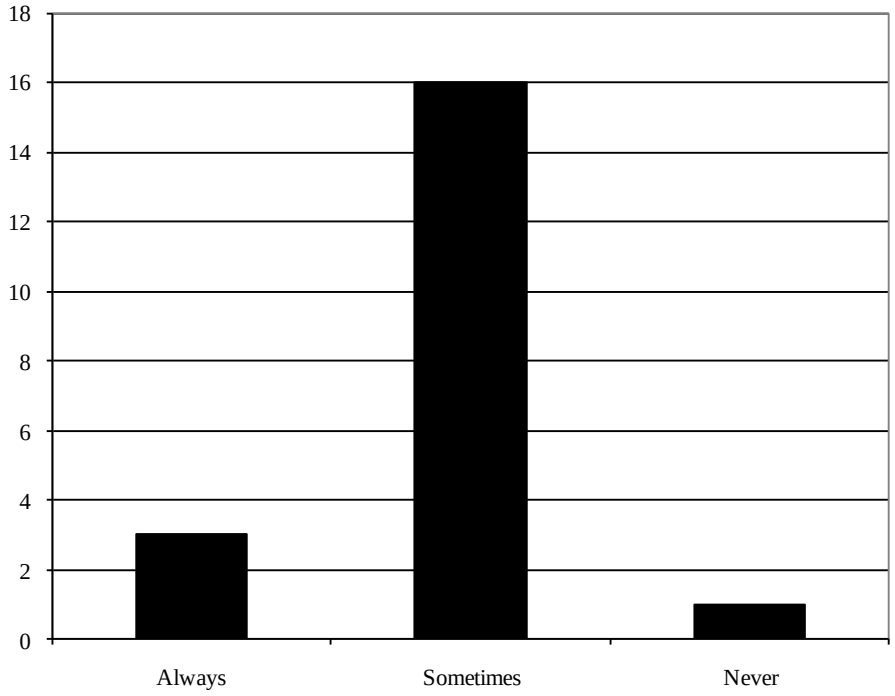

Figure 1. Teachers' Responses on Availability of Calculators to Students

The results in Figure 1 indicate that the highest frequency of teachers agree that students sometimes have calculators while a very small frequency claims that students never have calculators. The calculators are therefore not available to all students. On the response of how often students used calculators, 19% of them always use the calculator, 72% sometimes use and 9% never use the calculator. A total of 91% at least use the calculator. This implies that the calculator is an essential learning tool and should be availed to the students all the time. The calculator complements students ability to solve problems as indicated by the responses of the students when they were asked how often they use calculators when doing examinations. Forty four percent of the students always use the calculator in examinations, 47% sometimes use while 9% never use. A total of 91% report that they at least use the calculators in examinations. This agrees with research conducted by Pomerantz (1997) that the calculator is essential in learning and teaching mathematics and can be quite effective aid when it comes to problem solving.

The teachers encourage their students to use the calculator as indicated by the students response. Twenty percent of students are always encouraged by their teachers to use the calculator and 64% are sometimes encouraged. Only 16% are never encouraged to use the calculators. A total of 84% indicated at least their teachers encourage them to use calculators. Some computations may not necessarily require the calculators and teachers prefer to instruct the students to perform calculations mentally. Students need to be taught to develop good mental estimation skills, internalize concepts and perform simple calculations without calculator. The results of the study are consistent with the findings of Noraini (2002) who concluded that calculator should not be a substitute for learning to do mental operations but as a tool to let students explore and afterwards the teacher should explain things and justify the mathematics rule.

Attitude of students towards use of the calculator

The hypothesis stated that there is no significant relationship between use of calculators and attitude towards mathematics by form three students. The researcher investigated this by using likert five point scale from 5 (Strongly Disagree) to 1 (Strongly Agree). When the students were asked whether they work out more problems per day with calculators, a total of 60% indicated positively. The students do more computations when they have calculators. The result comply with the findings of Suydam (1985) that the calculator enables students to practice more problems since it gives immediate feedback and also Pomerantz (1997) that the calculator enables students to solve more problems and it stretches the students interest and increase motivation. The calculator motivates students to do more computations. A total of 85% of teachers believe that the calculator has influence on students' motivation in computations. The computations using calculator are less tedious as indicated by responses of the students in Table 1 when they were asked whether the calculators makes mathematics easy.

Table 1: Students' Responses on whether when they Use Calculators they finish the Work faster

	Frequency	Percentage
Strongly Disagree	42	11
Disagree	41	11
Undecided	27	07
Agree	120	33
Strongly Agree	139	38

The results on Table 1 show that 11% strongly disagree and 11% disagree that when they use the calculators they finish the work faster. However 07% of the students are undecided while 33% agree and 38% strongly agree that when they use the calculators they finish the work faster. A total of 22% showed negative reactions about the statement while a total of 71% were positive. This implies that when the students use the calculators, the computations are easier and faster. The results of this study agree with the findings of McClauliff (2004) who claimed that considerable amount of time is saved when the students use the calculators. The teachers also confirmed that the students take less time in computations when they use the calculators(59%). This implies that a calculator is an effective aid in calculations which enables students to take less time in computations. A calculator is an electronic device that is easy to operate and require simple instruction in order to use it as confirmed by the students responses. A total of 62% supported that calculators are not complicated to use while a total of 26% showed negative reactions. Students need to use their mental ability as they compute. This is indicated by the students responses as to whether calculators make them not think when calculating in Table 2.

Table 2: Students' Responses on whether Calculators make them Not Think when Calculating

	Frequency	Percentage
Strongly Disagree	118	32
Disagree	100	27
Undecided	37	10
Agree	58	16
Strongly Agree	57	15

The results on Table 2 show that 32% of students strongly disagree and 27% disagree that calculators make them not think when calculating. However 10% of the students are undecided while 16% agree and 15% strongly agree that calculators make them not think when computing. A total of 59% of the students are negative about this statement while a total of 31% agree that calculators makes them not to think when calculating. This implies that students need to use their mental ability as they compute. These findings are not consistent with the conclusion of Rey and Arbaugh (2001) who claimed that calculators inhibit logical reasoning of the students. The findings of this study agree with Pomerantz (1997) that the calculator does not replace mental ability to solve problems but it provides multiple solution techniques and also calculators do not think for students and sometimes it is faster to compute mentally. The calculator influences the students positively by bringing about a spark of interest to otherwise uninterested or bored students. This is confirmed by the responses of students when they were asked whether mathematics is interesting with a calculator. A total of 73% claimed that mathematics is interesting with a calculator while 18% of students were against. At least 73% of students enjoy studying mathematics using a calculator for it generates more enthusiasm about mathematics. The hypothesis was tested by use of the chi-square test. The results generated are given in table 3.

Table 3The Chi-square Test Results

N	χ^2 computed	χ^2 critical	Degrees of freedom	p-value
370	272.42	9.49	4	0.05

The result in Table 3 show that the χ^2 computed is greater than χ^2 critical. The hypothesis is rejected and so there is a significance relationship between use of calculator and students attitude towards mathematics. The chi-square test results analysis reveals that the measures are statistically different at 0.05 α –level. There is evidence that use of calculator influences the form three student attitude towards mathematics. Generally the above results imply positive influence on students' attitude.

Conclusion

The study concluded that; Students often used calculators and more so in exams. The teachers encourage students to use calculators where necessary. The students believe that not all problems require use of calculator, they perform better in mathematics and work out more problems when they have calculators. When students use calculators they finish the work faster and also it makes mathematics easy. The calculator does not make the students confused and encourage them to think. The teachers said that calculator motivates students. According to the students mathematics is very interesting and enjoyable with calculators. In general use of calculators resulted in better students' attitude and thus enhances students' mathematics self-concept which raises and maintains their motivation to learn.

Recommendations

Based on the findings and conclusions made in the study, it is recommended that use of calculator be adopted for mathematics instruction at lower level by evaluation of education goals of mathematics and restructuring of the curriculum to incorporate the use of calculator at form one level. This is due to the positive influence exerted on the students' attitude when they use calculators. Mathematics educators should inform students, parents, administrators and other stakeholders of research results that document the advantage of including the calculator as one of the several tools for learning and teaching mathematics.

Mathematics teachers at all levels should promote the appropriate use of calculators to enhance instruction by modeling calculator applications by using calculators in instructional settings, by integrating calculator use in assessment and education, by remaining current with state of art of calculator technology and by considering new application of calculators to enhance the study and learning of mathematics. The curriculum developers should give order and treatment of most topics that need to be aligned to new technologies and innovations like use of calculator so that students can function with optimal advantage with the surroundings. The Ministry of Education should be prepared to deal with enormous challenges in mathematics education like use of calculator to forge ahead because holding on the old and familiar ways would mean putting students at a disadvantage in a world that is fast embracing technology. The government should subsidize the price to ensure the calculators are cheap and affordable to many students or the calculators could be supplied to schools because teachers and students need access to them before any useful application can occur.

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