USING COMPUTERIZED TEACHING TRICKS FOR LEARNING AND UNDERSTANDING MATHEMATICS IN PRIMARY SCHOOLS

MGENI ATHUMAN

MASTER OF SCIENCE IN COMPUTER SCIENCE

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USING COMPUTERIZED TEACHING TRICKS FOR LEARNING AND UNDERSTANDING MATHEMATICS IN PRIMARY SCHOOLS

BY

Mgeni Athuman

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Computer Science.

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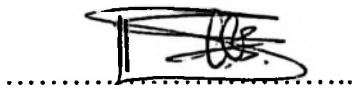
CERTIFICATION

The undersigned certifies that he has read and hereby recommends for an acceptance by the University of Dodoma, the dissertation entitled **"Using Computerized Teaching Tricks for Learning and Understanding Mathematics in Primary Schools"** in partial fulfillment of the requirement for the degree of Master of Science in Computer Science of the University of Dodoma.



Professor. L.J. Mselle

(SUPERVISOR)

DATE....05-02-16.....

DECLARATION

AND

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I, Mgeni Athuman, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature.....

ACKNOWLEDGEMENT

I would like to express my gratitude to all those who in one way or another contributed to the completion of this study.

First and foremost my thanks to ALLAH, the creator of everything that exist.

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DEDICATION

To my lovely late grandparents.

ABSTRACT

The objective of this study was to develop a computer model that will be included in teaching pupils mathematics so as to make it more fun and interesting to learn. The model contains digitized contents, video shooting lessons and questions randomly generated for exercises. Data were collected through interview, questionnaire, observations and document review while the questions were built using Java language via code and fix.

Twenty (20) pupils from Chief Albert primary school, nine (9) from Kikundi primary and twenty (20) teachers from various primary schools were involved in the study.

Lesson sessions were prepared through video shooting and presented to pupils. With each session, each group of pupils did questions generated from a standalone computer. Clarifications on matters not understood were demonstrated verbally.

Selected behavior patterns of pupils were observed during the sessions. This was done to detect their interest rate on the topics conducted. Questionnaire was filled by pupils before and after the study, while teachers filled them after the digitized contents were presented to them. Interview was conducted to primary school teachers on matters related to the lesson plan used by the school and common approach used by teachers in teaching mathematics to pupils.

Findings revealed that pupils at large seemed to be active during class sessions as well as during question sessions using the detecting variables set by the researcher. Also majority of teachers preferred the digitized contents to be included in the primary school curriculum since they can act as a catalyst for pupils to learn and understand mathematics.

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LIST OF ABBREVIATIONS AND ACRONONYMS

AcTSE	Active To Some Extent
ATSE	Attentive To Some Extent
CIVE	College of Informatics and Virtual Education
COSTECH	Commission for Science and Technology
HESLB	High Education Student Loan Board
ICT	Information and Communication Technology
IICD	International Institute for Communication and Development
LAc	Least Active
LA	Least Attentive
MoEVT	Ministry of Education and Vocational Training
NAcAA	Not Active At All
NAAA	Not Attentive At All
NECTA	National Examinations Council of Tanzania
NGO	Non Government Organization
PC	Personal Computer
PEDP	Primary Education Development Program
SEDP	Secondary Education Development Programs
SIDA	Swedish International Development Agency

TAMWA	Tanzania Media Women's Association
TEHAMA	"Teknolojia ya Habari na Mawasiliano"
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTR	United Tanzania Republic
VAc	Very Active
VA	Very Attentive

CHAPTER ONE

INTRODUCTION

1.1 Background

In Tanzania, primary school enrollment has been increasing with years (Wedgwood, 2007).The number of children enrolled in primary schools has increased by over 3 million since the year 2000. This rapid growth is a result of the decision to drop primary school fees in 2001 and the instigation of the Primary Education Development Programme (PEDP) in July 2002 (Mungai, 2005).

According Wedgwood (2007), teaching mathematics in primary school has been a great challenge for years now and pupils' under-performance in this subject in Tanzania has been an ongoing issue. The problem is common at all levels from primary to secondary levels (Swarts and Wachira, 2010).

Primary school pupils are still having hardships in grasping simple basic mathematics concepts of addition, subtraction, division and multiplication (UNICEF, 2007).

Apart from the number of pupils per class factor, other reasons may be attributed to the negative perception of mathematics among pupils. According to (UNESCO Annual Report, 1988) learners and the society at large have negative attitudes towards mathematics and science subjects. Teaching approach is yet another problem as most teachers use non participatory method of teaching whereby the teacher is the overall source of information. As a result in a big class, pupils sitting far away from the teacher

may not pay attention to the teacher who is talking at the front of the class (Mwalongo, 2012).

The increased failure of pupils and students in their final examinations at primary and secondary levels particularly in mathematics has led to various stakeholders to seek for solutions. These solutions include; remedial programs aimed at training mathematics teachers (MoEVT, 2007), preference in admission of students majoring in science subjects for loan provision, publication of mathematics books and periodic hosting of workshops on mathematics teachings (CANP4 East Africa, 2014). However these solutions have had limited impact on the problem (Hamilton, Mahera, Mateng'e, Machumu, 2010).

Swarts and Wachira (2010) have suggested the use of Information and Communication Technology (ICT) tools which are becoming useful and supportive across education and other development sectors. This has been acknowledged by various stakeholders but still its implementation faces some challenges bearing minimum positive output (MoEVT, 2007). This is because the majority of teachers and schools lack the knowledge and financial support of having computers in order to effectively facilitate learning to the pupils.

The Southern African Department of Education uses "technology enhanced learning" as a phrase to describe the use of technologies in the teaching and learning environments for any education-related purpose (SAIDE Report, 2001). This however has not been the case for many primary schools in Tanzania.

Since primary school determines a pupil's lifelong attitude toward mathematics, all possible means to create interest, confidence and a positive attitude during primary education must be used and the computer is one of the most powerful tools for doing this. One study conducted in Greece showed that the gaming approach in teaching was both effective and motivational in promoting students' knowledge of computer memory concepts more than the non-gaming approach (Papastergiou, 2008).

Therefore this study sought to enhance a pupils' understanding of mathematics through the use of computerized teaching tricks for learning and understanding mathematics in primary schools.

1.2 Statement of the problem

Nyirenda (2013) acknowledges that the remedial programs of training mathematics teachers have been more focused on training secondary school teachers. For example the Policy for Basic Education which was launched by the Ministry of Education and Vocational Education in 2007 was meant to integrate ICTs in pre-primary, primary, secondary and teacher education, as well as non-formal and adult education. But most of the activities implemented were within the secondary school level, with negligible movement in primary and lower levels. Also from 2004 – 2005 the government recruited secondary school teachers up to two months. These teachers were known as licensed teachers (Nyirenda, 2013). As such it can be observed that primary schools were excluded. Also the e-school forum was adopted to equip schools with educational management information systems at both the school and ministry level, and develop curriculum and on-line content for secondary schools (Nyirenda, 2013).

In 2002 through the ICT-connect-TED program, efforts to develop ICT in the teachers training colleges have managed to provide 44 teachers training colleges with computers and networking infrastructures. Again it can be observed that primary schools were excluded. Not only that but also preferential in admission of students doing well in science subjects apply only at university level. There is little or no motivation at all for students doing well in mathematics subjects at primary level (HESLB, 2014).

Thus it can be observed that these intervention programs have come short of success in promoting primary pupils to take and improve performance in mathematics and fail rate continues to grow.

Teaching procedures have not changed much. Basically same approaches of teaching have been practiced to larger class size. It is argued that education should use ideas that fit into practical problems of teaching and search for ways of extending theoretical and practical knowledge by testing it against complex demands of the classroom (Myers, 1975).

Tanzania's Ministry of Education and Vocational Training (MoEVT, 2007) has been working in cooperation with international bodies such as Swedish International Development Agency (SIDA), International Institute for Communication and Development (IICD) and UNESCO on the potentials of applying ICT in the educational sector by deploying and developing a countrywide e-learning system. As part of the government policy for introducing ICT into basic education, the Commission for Science and Technology (COSTECH) and IICD implement rural ICT access initiatives which aim to bring to the community affordable technologies for good

governance and transparency and as part of assisting national institutions in establishing computer-mediated (MoEVT, 2007).

An aggregate solution on the failure of mathematics subject at all levels has been elaborated as mentioned above but these aggregates tend to favor secondary school students at large.

It should be noted that our country still has good books and good mathematics teachers who can motivate pupils to learn the subject. Also the capability of equipping a good number of primary schools with computers and other necessary IT learning tools which can be used to facilitate learning among the pupils is possible but what is lacking is the mindset and technical knowhow on the part of the ministry and stakeholders concerned.

The computer and electronic devices can be used as a means of facilitating learning to the pupils in that the teacher may teach the pupils through the use of these devices so as to stimulate the mind of the pupils meaning that they are entertained while at the same time learning. These techniques can also be used by recording the pupils while the teacher is teaching and then through the use of the video other pupils can also learn, this is useful in areas where there is a lack of teachers. The pupils can be left with the video to watch while under minimal supervision of an assistant teacher.

While using the computers as a method of facilitating knowledge, the teacher is able to record the performance of the pupils and also the teacher can compile various videos contents while teaching so that they can be kept as references for others to benefit is a possibility. The problem is that we are short of implementing such ideas. So there is a

need to compile these methods and tricks used and digitize them so that teachers and pupils may benefit from the experiences and knowledge of others.

Since primary school determines a pupil's lifelong attitude toward mathematics, all possible means to create interest, confidence and a positive attitude during primary education must be used and the computer is one of the most powerful means of doing this.

As such a simple computer teaching tricks learning model/application that will help improve pupils' interest, attitude and confidence in learning mathematics is proposed.

1.3 Research objectives

1.3.1 General objective

The overall objective of the study was to use computerized teaching tricks for learning and understanding mathematics in primary schools.

1.3.2 Specific objectives

i. To identify working tricks used by primary schools by competent teachers.
ii. To model a computerized mathematical teaching aid based on popular tricks.
iii. Testing the model.

1.4 Research questions

i. What are the basic tricks used in teaching mathematics?
ii. Which tricks among the available will be feasible for developing a digital platform?
iii. How efficient is the computerized mathematical model in teaching mathematics?

iv. What is the impact of the platform in comprehending mathematics?

1.5 Significance of the study

Many pupils and students have poor perception that mathematics subject is difficult to be pursued by them. The government is now trying to make sure that much emphasis is put on recruiting mathematics teachers and employing them in schools. Despite of these efforts by the governments, most of the pupils and students are still performing poorly in mathematics, therefore this study intends to design a computer model that is expected to solve some of the problems. The significance of this study is thus:

i. To provide policy makers with more knowledge pertinent to the use of ICTs in education to reduce the severity of lack of paper materials.
ii. To find out if this model is implemented efficiently and effectively in the study area, pupil's interest and confidence in mathematics subject will improve.
iii. The study will shed more knowledge on how computers can be used to improve knowledge.

1.6 Scope of the study

This study is mainly designed to create a learning computer model to test if pupils' confidence and desire/interest towards mathematics can be affected. It is not therefore designed for schools lacking computers neither to replace other teaching techniques currently in use though in the future such schools may decide to emulate the model if it proves to be successful.

1.7 Chapter scheme

This dissertation contains five chapters. Chapter one presents, the background, statement of the problem, research problem, research objectives and appropriate research questions. Also the significance of the study and scope of the study were outlined in this chapter.

Chapter two focuses on the theoretical and empirical review of the relevant literature on the use of ICT in facilitating learning. This chapter also developed a conceptual framework from the literature review.

Chapter three is devoted to description of research methodologies used for conducting the study. It shows the research design, research settings, sample design and sampling procedure, type and source of data. Description of how data was collected, analyzed and presented was preceded by consideration of issues of validity reliability and ethics in this research.

Chapter four concentrates on data presentation, analysis and discussion. It starts with description of the demographic characteristics of the study. Then it proceeds to present and discuss the findings that answered the research questions. The data presented show what the respondents had to say about the research problem.

Chapter five presents a summary, conclusion and recommendations of the study. It is the concluding part of the dissertation where a summary of what has been observed in the field is presented. Based on the findings the chapter proposed recommendations and also indicated areas for further study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is devoted to the review of literature in order to understand and highlight the concept and theories related to the use of ICT and empirical studies on the role of computer models in imposing mathematics tricks to pupils.

2.2 Definition of key terms

2.2.1 Computer

A computer is an electronic device capable of performing computations and making logical decisions at speeds millions (even billions) of times faster than human beings. It constitutes the following major characteristics: speed, storage, flexible, accurate and diligence (Deitel, 2006).

2.2.2 Information Technology

Information Technology (IT) is the study or use of systems for storing, retrieving and sending information (Tilya, 2007).

2.2.3 Information Communication Technology

An umbrella term that includes any communication device or application such as radio, computer and satellite systems (Tilya, 2007).

2.2.4. Teacher

Someone who teaches, especially in a school (Liebeck, 1981).

2.3 Status of ICT in primary schools

Primary education in Tanzania is compulsory for all children aged seven years and above. It aims at equipping pupils with permanent literacy and numeracy, basic life skills and values to allow them to be in a position where they can be productive in the society and pursue further education and training (UTR, 2003)

Tanzania has a curriculum for ICT in primary and pre-primary education; referred to as "Teknolojia ya Habari na Mawasiliano" (TEHAMA). Currently, this subject is only taught in some schools. Very few primary schools have computers. Majority of schools have radios, but only a few have TVs, and these are restricted to areas that have electricity (MoEVT, 2007). As a result, most schools still use the normal traditional ways of teaching that includes using chalks to write on a blackboard to a relatively large class size with very little involvement from the pupils. With such shortages and using traditional ways of teaching using limited facilities, it is no coincidence that lack of interest, motivation, confidence and desire in learning mathematics has dropped significantly (Rallis, 2000).

In Tanzania, there have been several initiatives related to the integration of ICT in institutions ranging from primary schools, secondary schools, colleges to universities. The main aim has been to improve education in primary schools, secondary schools, teacher training colleges, vocational education colleges, higher learning institutions and other related institutions that deal with the provision of education. Tanzania has already

developed an ICT policy for basic education which incorporates the integration of ICTs in pre-primary, primary, secondary and teacher education, as well as non-formal and adult education. The policy considers issues of infrastructure; curriculum and content; training and capacity development; planning procurement and administration; management, support and sustainability and monitoring and evaluation (Nyirenda, 2013).

Though several solutions have been proposed and some implemented to some of the primary schools particularly private schools, no significant difference is noted among these schools.

When we analyze the efforts made by the government we still find that, despite all the efforts attempted, still there is some limited use for teaching basic ICT skills.

The proposed solutions do not seem to favor primary schools level. In most cases ICTs have not been integrated as a medium of instruction. Most of the activities can be observed from the secondary school level and above and these activities are in large used for typing the lesson notes, using to keeping students records, performing simple computations such as averages, and total scores in spreadsheets .Very few teachers use ICT in teaching (Ottevanger et al., 2007).

Some studies report that, the delay in ICT development in education in Tanzania is caused by the apparent lack of commitment by the government, schools and teachers. Kafyulilo, (2011) reports that the challenges that have been hindering technology integration in science and mathematics in Tanzania schools are: Most of the schools,

experience a shortage of technological tools and schools having defective computers. As such, status of ICT in primary schools as far as teaching is concerned is still low.

2.4 Theoretical framework of the study

The Bloom/Anderson taxonomy is a useful learning model and is widely used as a planning tool in educational settings (Krause, Bochner, & Duchesne, 2006), and has been applied in various education domains from primary to higher institutions for course design and evaluation (Thompson, Luxton-Reilly, Whalley, Hu, Robbins, 2008). However, the approach has seldom been used for designing computer-based educational applications for schools. In the study being discussed here, the Bloom/Anderson taxonomy was used to form the design of a mathematics educational framework, which has in turn underpinned the design and development of a computer-based application to facilitate the teaching and learning of mathematics concepts to pupils in primary school classrooms.

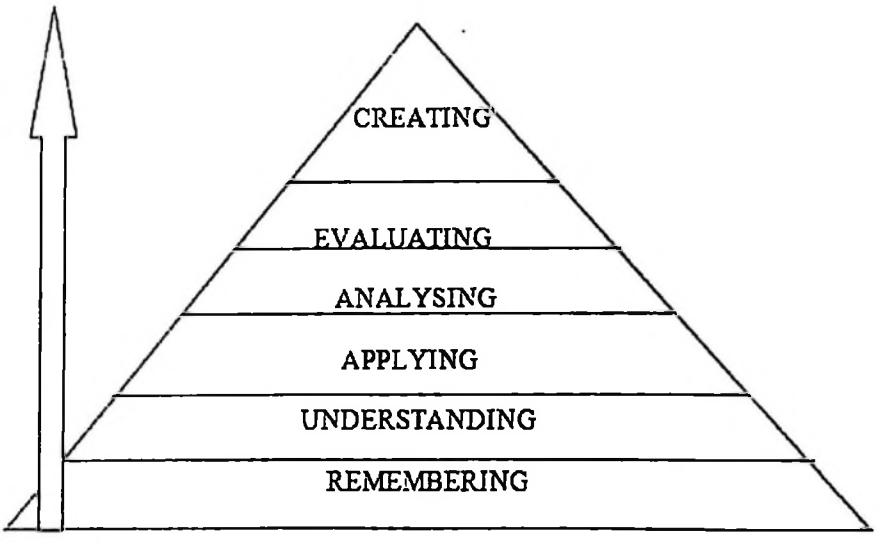

Figure 2.1: Bloom/Anderson taxonomy

Figure 2.1 illustrates the base of the Bloom/Anderson taxonomy, which consists of six major categories which are Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating (Anderson, 2001). The first three categories of Remembering, Understanding and Applying require a good deal of involvement and scaffolding from teachers, and focus on knowledge, comprehension and application. The last three categories are more sophisticated and need higher orders of thinking by learners.

For the purpose of this study, Bloom's Taxonomy is used because it shows how a pupil through the use of information technology is able to remember and understand what he or she has been taught than if the pupil was taught using the blackboard alone. Moreover the use of videos can help a pupil apply the concept which he or she has been taught by the teacher through the course of the lesson.

2.5 Current performance of mathematics subject in primary education

Currently, the performance in mathematics in Tanzania primary schools is dropping with time. Much has been said on the causes for poor performance especially for mathematics and science subjects.

According to a report released recently by Tanzania Media Women's Association (TAMWA), lack of mathematics and science teachers featured out prominently in many schools in the country, most of the community schools have little or no teachers in such subject, (Yamkami, 2014).

Also it is claimed that poor performance in schools is mainly caused by the shortage of teachers, shortage of teaching and learning facilities; unbalanced ratio of the number of books per students' number in the school (COSTECH, 2011).

While it should be acknowledged that the government is doing a fairly good job to reduce the deficit by providing books and teachers, still it will take years before all schools are equipped with enough teachers. Other alternative solutions are thus needed to compliment for the current shortage. This was confirmed by the then the Minister of Education and Vocational Training Professor Jumannne Magembe who stated: "Despite of all initiatives made by the government to improve education, still have failed to provide all schools and training institutions with enough and appropriate instructional materials and standard physical infrastructure due to the shortage of funds."

2.6 Current computer based mathematics applications and their limitations

It has long been claimed that the use of computers can increase the mathematical achievement of children in pre-school and primary grades (Clements, 1993), and the largest gains so far appear to have been with the use of mathematical training and practice software (Yelland, 2001). In recent years, teaching and learning mathematics through computer based education software has been growing rapidly. However, although several educational software and applications have been developed, many of them have not been successfully used in the school setting. Evidence shows that much educational software is commercially produced and is not widely accepted by educators, policy makers and researchers (Kingsley & Boone, 2008). Studies have shown that software is rarely designed with an appropriate pedagogical framework in mind (Laurillard, 2009; Mumtaz, 2000; Patten, et al., 2006) and, also, has little consideration for the teaching contexts in which it is supposed to be used (Hinostroza & Mellar, 2001).

2.7 The role of computer models in imposing mathematics tricks to pupils

Brook (1994) ascertains the impact of education technology. To him, the use of technology in classroom could simplify teachers work and enhances pupils' understanding through the use of various media. The purpose for including multimedia in classroom is to increase pupils' motivation, through visual and auditory enrichment and to meet individual learning style, to extend the learning beyond text book reading and reducing one way traffic teaching.

Farrant (2012) disclose the necessity of education technology and the implication of various theories of learning. The concept of positive classroom to him is a key factor to enhance the whole process of teaching and learning in educational environment. The learning environment should treat the pupils fairly and motivate them to learn.

Kim et al. (2006) also portrays the resources useful for teaching and planning for competence. A resourceful learning environment will obvious favor teachers and pupils and create a conducive environment and sounding performance.

ICT can transform the way education is delivered and open the way to a new pedagogy. It can make it easier for teachers to plan and find high quality materials, and it can help pupils to find out more about the subjects that they are studying. Furthermore, ICT can simplify pupils' understanding of different abstract concepts; make them more active via teaching in the clarification of concepts, and activeness of the pupils in learning (Mwalongo, 2012).

It can thus be deduced that ICT enhances particular concepts and skills and improve students' attainment, it enhances the existing topic through some aspect of the lessons

and tasks, it empowers the pupils' learning, for example by enabling them to improve their class work by taking notes on the computer, or by saving homework on the desktop or by word processing their homework (UNESCO, 2004).

One way to enhance these concepts to make mathematics interesting to learn is to know how certain concepts can be solved in a relatively short amount of time. These concepts are termed as mathematics tricks by most authors and they have been compiled to some extent.

Davidson (2010) who has been teaching mathematics using elaborated tricks has suggested that his tricks methods may even be used anywhere and be successful. Among used ones include how to solve area of rectangles as elaborated below.

To find the area of a rectangle that is "x units" tall and "y units wide", simply draw a grid that is "x units" tall and "y units" wide. Smaller magnified units of x and y may be used in case x and y are large values. Thereafter count the number of squares obtained and that becomes the answer as far as the quantity is concerned.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20

Illustration 2.1: Area of a 4 by 5 rectangle using cells

Liebeck (1981) has provided a guide for parents and teachers that can be used to guide their children and students using easy well guided tricks. Among them include easy steps for addition and subtraction.

Pupils at times will have a hard time to directly solve values such as "5+3 or 5-3". Thus real objects that are easily understood may be used as an aid. Pupils would easily grasp

if they were told for example "if you have 5 sweets on your left hand and 3 sweets on your right hand how many total do you have?" or "if you have 5 sweets on your left hand and your sister takes 3 sweets from you how many are you left with?" These symbols can even be drawn for further elaboration.

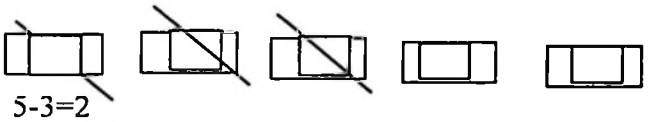

Illustration 2.2: Subtracting using items

(Tandi, 2007) claims that diagrams may be used to inject pupils' interest towards the subject. Pupils who can take in and remember a series of instructions and formulas, or rules for finding operations such as adding fractions are likely to achieve high grades.

But there are few who can achieve such accomplishment and majority of them such rules and procedures seem meaningless and thus will have great difficulty recalling them, and cannot use them efficiently to solve problems. They may struggle to make sense of the symbols and instructions as a result give up in despair.

The main purpose of diagrams is to develop the pupils' understanding, so they do not just learn how to use a method to solve a problem, but they also understand why it works. For example a number line diagram may help some pupils to see a subtraction as finding the 'distance' between two numbers.

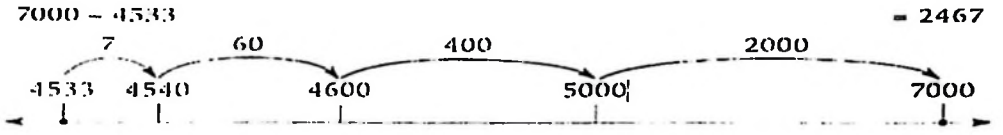

Illustration 2.3: Subtracting using lines

This approach may make much better sense than using formal standard algorithm illustrated below.

$$\begin{array}{r} 7\,0\,0\,0 \\ -\,4\,5\,3\,3 \\ \hline \\ \hline \end{array} \qquad \begin{array}{r} 6\,9\,9 \\ \not{7}\,\not{0}\,\not{0}\,\not{0} \\ -\,4\,5\,3\,3 \\ \hline 2\,4\,6\,7 \\ \hline \end{array}$$

Illustration 2.4: Subtracting using normal procedures

Subtract 3 from 0 ___ Impossible ___ Borrow 1 from 0___ Impossible to borrow ___ borrow 1 from the next 0 ___Impossible to borrow one ___ borrow one from 7___cross out the seven and put six ___ make ten in the next column___cross out the ten and make nine ___ make ten in the next column___ cross out the ten and make nine … and so on.

There has been limitations to the usage of such tricks in our country and a need exist to use them in our schools. By compiling them through the computers is likely to reach more pupils.

2.8 Conceptual framework of the study

The conceptual framework for the study on the use of ICT in mathematics provides an indispensible guideline for identifying study variables for successful and efficient data gathering. The researcher developed the conceptual framework for this study based on the literature review to depict the relationship between independent, intermediate and dependant variables.

2.8.1 Independent variables

The independent variables are the ones causing a change on the other variables in an experiment (Kothari, 2011). In this study the independent variables is the computer through the use of ICT. Technology is present in our everyday lives and it can be manipulated to solve a number of social related issues and for the purpose of this study it has been used to solve the problem of pupils in mathematics.

2.8.2 Intermediate variables

Intermediate variables appear in more complex causal relationship. They affect both the independent and dependant variable, showing the connection between them. Advances in knowledge depend on documenting causes and effect relationship and specifying the mechanism that explain the resulting relation. In this instance the intermediate variables are the teaching and learning methods used within the educational system to facilitate knowledge to the pupils.

2.8.3 Dependant variables

Dependant variable is the factor which is observed and measured to determine the effect of the independent variable, that is, aspects that appear, disappear or varies as the researcher introduces, removes or changes the independent variable. The dependant variable is the outcome of the experiment (Kothari, 2011). The dependant variables of interest in this study are interest and understand of the mathematical concepts which are being taught to the pupils.

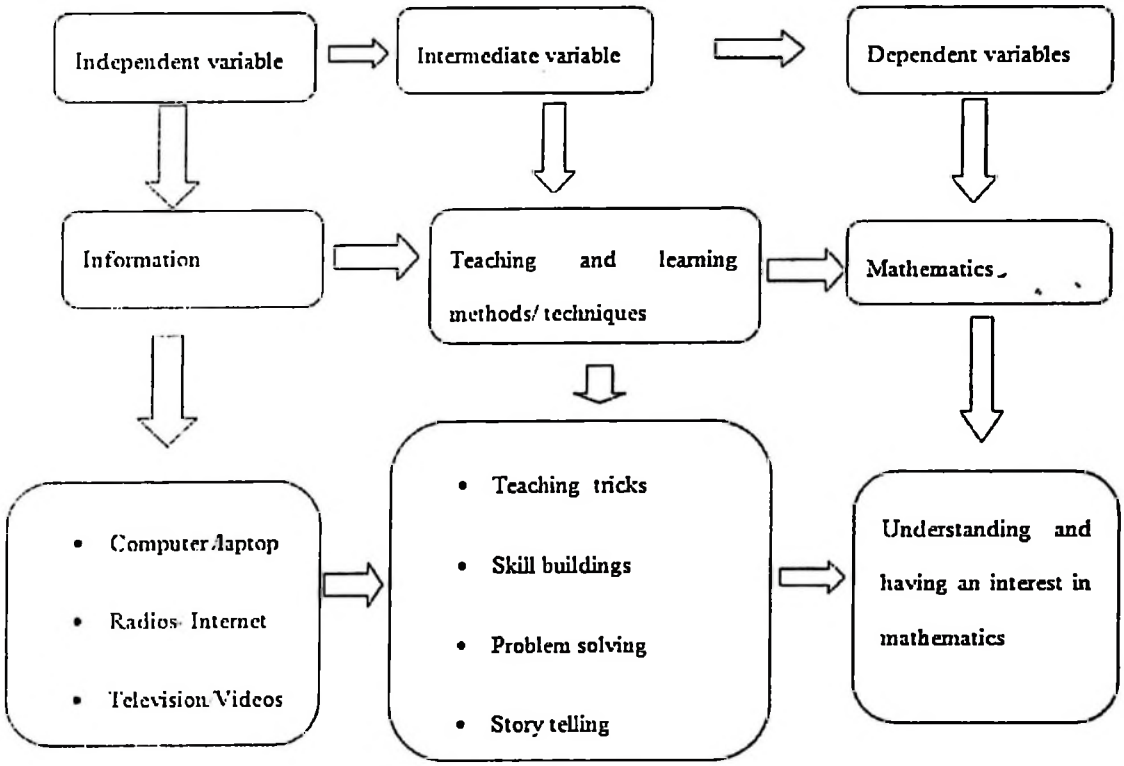

Figure 2.2: Conceptual framework developed from the literature review

2.9 Chapter summary

The chapter has dealt with a review of various literatures from published sources, journals, magazines and policies. It discusses the use of computer in applying mathematics. The following chapter discusses the research methodology applied in the study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter focused on the methods that will be adopted and used for this study with the aim of achieving the research objectives. It provides detailed description of the study area, research design, study population, sampling design, technique, size, frame and unit. It further describes how data was collected, analyzed and presented. The effort to ensure reliability and validity of the study were done. Finally ethical considerations of the study were described.

3.2 Research design

Research design is the conceptual structure within which research is conducted. It constitutes the blueprint for the collection, measurement and analysis of data (Kothari, 2004). The descriptive survey method was considered as the appropriate design because the study is directed towards people, their opinions, attitude and behaviors. Data was collected from pupils to find out their reputation on mathematics subject before and after the study. Also data was collected from teachers to give their views on the model after viewing the contents.

Also a case study design was used to get an in-depth contextual analysis of the study, flexibility in data collection methods and again to save time and money (Komba, 2006). Accordingly, the case involved in the study is an area of great importance to the educational well-being of the pupils and country at large as a number of things which are

done in our everyday lives involve the application of mathematics. Consequently, the findings of the study may be generalized for other cases.

3.3 Description of the study area

This study was conducted in Morogoro town. It involved Chief Albert primary school as well as Kikundi primary school located in the municipal area. Chief Albert primary school was chosen since it is the closest school in the municipal that possesses desktop computers while Kikundi primary was meant to be used for preparation of the digitized contents.

3.4 Research time

The study was conducted for one month. The first two weeks were spent for data collection in the field and the remaining weeks were used for data analysis and preparation of research document.

3.5 Sampling and sampling techniques

3.5.1 Sampling design

According to Kothari (2004) a sample is a specific small group or subset of a population selected for the purpose of making interference about the nature of the total population, or is a representative of the population to be studied. It makes the task of survey less costly and manageable. According to Berg(2001) samples have been found to give accurate results than using an entire population. Berg advocates that examining the whole population involves examining large numbers of items, hence much time is needed, it may include unskilled investigators, and this leads to so many errors that the

overall cumulative error is greater than the error inherent in using sample results to draw conclusions about the whole population (Berg, 2001).

3.5.2 Study population and sample

According to Berg (2001) population is a group of people or items about which information can be obtained from. The population of the study comprised of primary school teachers in Morogoro municipal as well as primary school pupils. Two primary schools were selected. From the selection, twenty (20) standard six pupils from Chief Albert primary school were randomly selected to participate to learn the tricks, while twenty (20) school teachers were purposefully selected to participate in the study. Nine (9) pupils from Kikundi primary school volunteered for the video shooting to be used in the study.

3.5.3 Sampling techniques

Various sampling techniques were carried in order to collect information and provide basis for analysis. The samples used were stratified random sampling and purposive sampling.

3.5.3.1 Stratified random sampling

The study used a stratified random sampling procedure. Stratified random sampling is the grouping of the representative composing a population into homogeneous groups before sampling (Babbie, 1992). The participants in this study who were chosen through stratified random sampling were standard six pupils from Chief Albert primary school who were twenty (20).

3.5.3.2 Purposive sampling

Purposive sampling refers to a non-probability sampling in which the researcher selected the respondents to be interviewed on the basis of the researcher's own judgment about which respondents were most useful representatives. In addition to that, the respondents were selected by virtue of their positions and responsibilities (Babbie, 1992). The respondents selected for purposive sampling were the teachers. They were selected purposively because they are the ones who are teaching the pupils.

Also nine (9) pupils from Kikundi primary were selected for the shooting of the video purposely based on their ability to act as learners.

3.6 Data collection methods

Data collection for the study involved survey, interview, questionnaire and documentary review. The researcher employed a variety of techniques to triangulate information. According to Ary (1992) triangulation means that use of multiple methods to verify the findings. This was done intentionally on the ground that no single research technique or instrument is adequate in itself to collect valid and reliable data on a particular problem.

3.6.1 Questionnaires

Questionnaires were one of the tools which were used in this study. It has been defined by (Goode, 1980) as a device for securing answers to questions using a form which the respondents fill in. In this study two research questions were distributed to twenty (20) pupils and one to twenty (20) teachers. The first was distributed and administered to pupils before the study and the other was distributed and administered to pupils after the

study. To further improve communication, the questionnaires were translated into Swahili language. The third questionnaire was distributed to teachers after the digitized contents were presented to them.

Generally, questionnaire as a tool is relatively economic as it has standard questions to ensure clarity. The tool can also be administered to many people using a short time. However, the disadvantages of this tool are that some respondents may give answers that are essentially irrelevant to the researcher's interest (Shumacher, 1993).

3.6.2 Interview and interview guide

Kothari (2004) states that the interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses. This method can be used through personal interviews and, if possible, through telephone interviews.

(Kombo, 2005) is of the view that "the major advantage of interview is its flexibility, follow up of ideas, checking responses and exploring motives and feelings, which questionnaires cannot do as well."

Interview was conducted to twenty (20) teachers on matters related to the study plan, their views on pupils' performance and if they have ever interacted with mathematics computer learning tools.

This study used semi-structured interview for five key informants, the chosen respondents are considered to have a lot of additional information as it will enable the researcher not to repeat asking the questions already answered by the respondent when explaining issues asked. Such interviews involve the use of a set of predetermined

questions and of highly standardized techniques of recording. Additional probing questions were asked. The guiding questions were aimed to get information on how the pupils perceived mathematics and also how mathematics was taught to the pupils. Interview is chosen due to its strength of capturing empirical data in both formal and informal settings.

For this study, an interview guide was prepared and used as a tool for different levels of respondents; this involved presentation of oral verbal stimuli and reply in terms of oral verbal responses. This was important for collection of primary data.

3.6.3 Survey

Survey is an investigation of behavior of a particular group of people conducted by asking them probing questions. Survey is a preferable method for many studies because this is an approach most suited for gathering descriptive information for which the study is focused on (Kothari, 2009). During the study data was collected by surveying pupils to determine their behavior patterns. Patters that were observed included:

i. Extent to which pupils were attentive during presentation.
ii. Extent to which pupils were active during question discussions.

3.6.3.1 PATTERN-1: Extent to which the pupils were attentive during presentation

VA: Pupils were very attentive during session.

ATSE: Pupils were attentive to some extent during session.

LA: Pupils were least attentive during session.

NAAL: Pupils were not attentive at all during session.

3.6.3.2 PATTERN-2: Extent to which the pupils were active during question discussions

VAc: Pupils were very active during question discussions.

AcTSE: Pupils were active to some extent during question discussions.

LAc: Pupils were least active during question discussions.

NAcAA: Pupils were not active at all during question discussions.

3.6.4 Document review

Documents are stable sources of data that can be used repeatedly. They are valued because they can provide more insights into the study, by cross-validating and augmenting evidence obtained from other sources. For this study, the key documents involved both primary and secondary sources. Mathematics books used by the school were reviewed. The aim was to determine topics that are being taught to pupils sequentially to determine the best mode of delivery when designing the model.

Also the teaching methodology and lesson plan used by teachers was reviewed to determine which areas could be simplified and make them interesting in teaching mathematics.

3.7 Procedure

This study aimed to develop a model to be used to enable pupils to enjoy learning and understand mathematics. Branch of mathematics contents used in primary schools were

prepared. The study picked five simple topics that were writing numbers in long forms, addition whole numbers, subtraction whole numbers, and tricks of multiplication whole numbers in a few steps and how to recognize if a number is divisible by another number. Digital contents were prepared. Video shooting was also prepared to improve the enjoyment expected from the pupils. Nine (9) pupils from Kikundi primary school were selected to act as pupils who were to be taught these concepts. These contents and video were then used to introduce the concepts to Chief Albert primary school pupils using PC and projector. After every session pupils in groups of five were allowed to do exercises using stand-alone computers and ask further questions. The exercises were modeled using Java Program. Each session generated random numbers for each new exercise even if it is on the same topic. Pupils' behaviors were monitored during each session to detect if they were enjoying the session or not. Pupils were tested on the digitized contents two days after the representation to see if the concepts were stuck in their brains.

Apart from that, twenty (20) teachers were presented to watch the digitized contents and gave their views on the tricks as well as responding to the questionnaires.

3.8 Data analysis

Data collected from the study was analyzed using descriptive statistics of frequency count and simple percentage.

3.9 Model used

The code and fix was used to create random numbers related to the exercises done by pupils. The reason behind was to avoid the schedule pressure involved in other prototypes. Without much of a design in the way, with code and fix one starts immediately producing the code. At some point, testing begins and the unavoidable bugs must then be fixed before the product can be delivered. Below is a diagram that represents the code and fix approach.

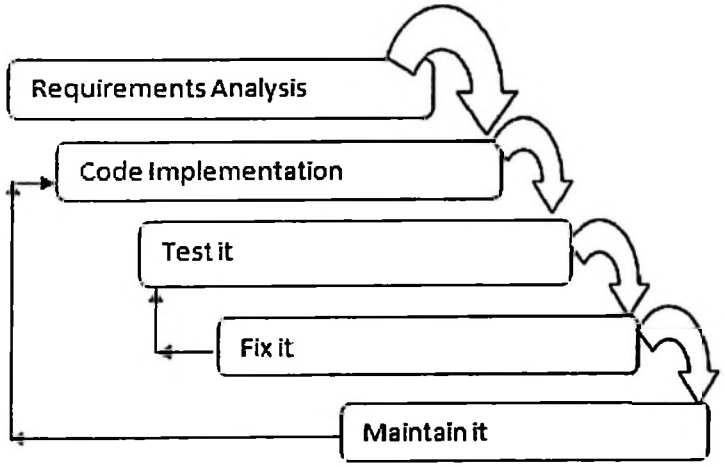

Figure 3.1: Phases of code and fix

3.9.1 Explanation of the phases

With code and fix, analysis is reduced to the bare minimum and one jumps immediately to the implementation phase where one begins producing code. The code is then tested and bugs fixed until bugs are no longer available. The product is delivered and any maintenance required while it is in operation is done.

3.9. 2 Advantages of the model

It involves simplified analysis and testing, quick results obtained and one immediately begin producing code and avoid making prototypes.

3.9. 3 Disadvantages of code and fix

It involves poor analysis and less maintainable code and may be difficulty in meeting the customers' needs.

3.10 Validity and reliability of the instrument

3.10.1 Validity

Validity refers to universal laws, evidence, objectivity, truth, actuality, deduction, reason, fact and mathematical data to name just a few (Rwegashora, 2006). Validity determines whether the research truly measures what was intended to measure or how truthful the research results are. It refers to whether the means of measurement are accurate.

Validity was ens ured by including a variety of questions, pretesting of the questionnaires prior to actual data collection also gauging the questions in the instruments to the study objectives so that all important aspects are taken into consideration and attention of researcher to opinions from the supervisor as well as from colleagues in the field. After consultation a modification of the instruments in light of the shared opinions was made. And finally, researcher had to correct the instruments, mistakes observed from the piloting.

3.10.2. Iteration

Iteration method was used as a cross checking techniques by returning to the respondents whenever there was a need to fill data gap or check its accuracy. The techniques are important for establishing validity. The researcher used it as a means of getting more details and approval of accurate information already obtained.

3.10.3 Pretesting of questionnaire

A pretesting of questionnaires or pilot study refers to a trial administration of an instrument to identify flaws. McNabb (2002) says a pilot study is a small scale design used primarily for gaining insight and ideas about the research problem variables and other associated with those problems. The main objectives of a pilot study is to determine whether questions and directions were clear to the respondents that they understood what was required of them, when the questionnaire was used as a data gathering instrument. The pilot study for this research was conducted within and outside various primary schools prior to actual gathering of data from the expected respondents. The testing of tools identified a number of problems, involving clarification of wording of the questions and permitting early detection of necessary additions or omissions that were dealt with accordingly.

3.10.4 Reliability

Joppe (2000) defines reliability as the extent to which results are consistent over time and an accurate representation of the total population under study. If the results of a study can be reproduced under a similar methodology, then the research instrument is

considered to be reliable. It refers to whether the result is replicable and whether they are actually measuring what they are intended to measure.

The researcher ensured reliability by minimizing sources of measurement error through personally administering the questionnaires and conducting interviews thereby standardizing conditions that exhibit similar personal attributes to all respondents. Further, the physical and psychological environment where data were sought was made comfortable by ensuring privacy and confidentiality. The pilot study was also used to ensure reliability of the instruments.

3.11 Ethical consideration

Ethical considerations are of extreme importance as indicated by Goode (1952). This research was in line with ethical guidelines in that the main ethical issues were considered when conducting research including the voluntary nature of participation, reduction risk for participants, ensure confidentiality and privacy of participants and institutional issues which include obtaining permission to conduct the research.

3.11.1 Voluntary participation

The right of respondents to participate in the research or not as they chose was respected. All respondents participated freely after receiving the information on the study and their rights to answer the questions or not.

3.12 Limitation of the study

The research was conducted within a framework of the following constraints and limitations.

3.12.1 Time constraints

The time allocated for the field work, data collection, data analysis and report writing was limited to ensure carrying out a comprehensive field research within the sample size. The researcher solved this problem by working even on weekends, asking the respondents to pardon him for the inconvenience.

3.12.2 Fear and inadequate transparency to share information on financial issues

In case of some of the respondents, there was no transparency in sharing information or appropriate data on their teaching methods and techniques. They feared that such information was sensitive and they never wanted other people to know how they taught in the classrooms.

3.12.3 Financial constraints

Funds available were very insufficient to enable collection of large samples of data from the relevant respondents and.

3.12.4 Over expectation for payments

Some participants were reluctant to share their views during the meetings because they expected to be paid some money for this exercise.

3.13 Chapter summary

The chapter discussed the methodology used to conduct the study. The quantitative and qualitative (descriptive) used; stratified random and purposive samplings were used to select forty nine (49) respondents for the study.

The chapter also discussed the data collection methods and instruments, survey and face to face interviews by interviewer. Validity and reliability of measurements and findings as well as ethical considerations were also discussed in this chapter, apart from data analysis design.

CHAPTER FOUR

FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents, interprets and discusses primary data obtained from the field and secondary data obtained from written documents relating to the study. Analysis and presentation of data revolved around three specific objectives and all the significant information collected from other sources including library documents and reports. The specific objectives of the study were to identify working tricks used by primary school competent teachers, to model a computerized mathematical teaching aid based on popular tricks and finally testing the model.

4.2 General characteristics of the respondents

4.2.1 Sex of the respondents

Table 4.1 shows the sex of the respondents within the study. The results are as follows: 28 (57.1%) were female while 21(42.9%) were male. This shows that the majority of the respondents were female.

Table 4.1: Sex of the respondents

S/N	Sex	Frequency	Percentage
1	Male	21	42.9
2	Female	28	57.1
Total		49	100.0

The results of table 4.1 show that there are more females than they are male respondents in the study. According to the population censor conducted in 2012 in Tanzania it shows that in Tanzania there are more female than male (UTR,2012).

4.3 Pupils' preference to mathematics

Table 4.2: Pupils' preference to mathematics

S/N	Response	Frequency	Percentage
1	Yes	7	35.0
2	No	13	65.0
Total		20	100.0

According to Table 4.2 the results are as follows: 7 (35.0%) of the pupils liked mathematics while 13 (65.0%) did not like mathematics. The table 4.2 shows that majority of the pupils do not like mathematics subject. This is probably caused by the society at large who make pupils to believe that mathematics is a hard subject (UNESCO Annual Report, 1988). It may also be attributed to incompetence of mathematics teachers and lack of mathematics teachers. Also it may be caused by lack of commitment from the government. Questionnaire revealed that a good number of pupils do not like mathematics because they feel the teacher is not competent enough while some teachers interviewed said that the government is not serious enough in matters related to education.

4.3.1 Reasons for liking/hating mathematics

Figure 4.1 shows the responses from the respondents of whether they liked or disliked mathematics. The overall majority of the pupils 9 (45%) disliked mathematics because they considered it as a difficult subject. In regard to this, majority of the pupils stated

that they always fail the subject or they do not understand the subject. 4 (20%) of the pupils stated that they dislike the subject because in their opinion, the teacher is not good in handling the subject. Also 4 (20%) of the pupils stated that they like the subject because they are aware that current and future jobs do demand knowledge in mathematics. In regard to this, majority of the pupils stated that they like the subject because it will enable them to know how to do business or it enables them to perform their daily activities or it will enable them to be pilots, while 3 (15%) of the pupils stated that they like the subject because it will expand their knowledge. In regard to this, majority of them stated that they like the subject so that they can know how to calculate areas and perimeters of various figures or to be able to perform other subjects.

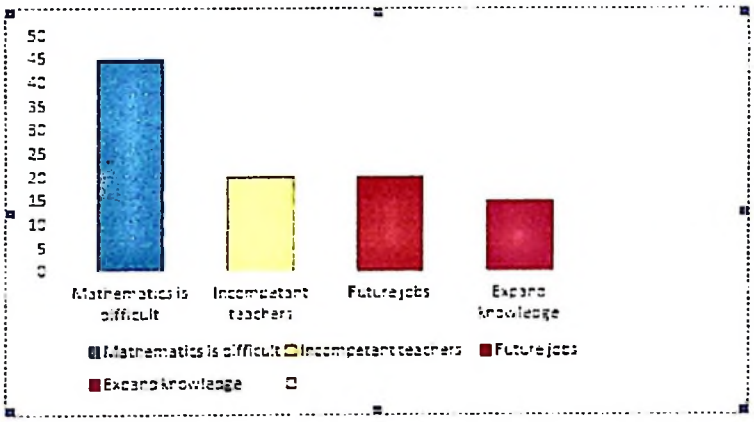

Figure 4.1: Reasons for liking/disliking mathematics

4.4 Teaching mathematics by computers

Findings of the study revealed that 100% of the respondents stated that they had never been taught mathematics by using computer applications. This is probably due to the fact that the government has not done enough to train teachers to a reasonable extent on the computer mathematics application programs. In addition, during the interview

several teachers confirmed to this fact. While one of the respondent stated that he has never been trained on ICT related issues, another said that she has been trained only once more than five years ago.

4.5 Extent to which pupils understood individual taught contents

Table 4.3 shows that the contents were highly understood by the respondents. This may be attributed to the fact that the use of technology in classroom if well modeled, usually simplifies and enhances understanding and is likely to increase pupils' motivation (Brooks, 1994). Furthermore, ICT can simplify pupils' understanding of different abstract concepts; make them more active via teaching in the clarification of concepts, and activeness of the pupils in learning (Mwalongo, 2012).

Table 4.3: Extent to which pupils understood individual taught contents

S/N	Responses	Addition	Subtraction	Multiplication	Division	Rate %
1	Very useful	14	14	18	15	76.25
2	At least useful	3	5	1	5	17.50
3	No difference	1	0	0	0	1.25
4	Slightly difficult	2	1	0	0	3.75
5	Very difficult	0	0	0	0	0.00
6	No response	0	0	1	0	1.25

4.6 Duration of teaching mathematics

These questionnaires were responded by primary school teachers after watching the video contents, reading the digitized notes and getting a brief summary of other extra tricks not included in the digitized contents. They were also briefed on how these contents may help build pupils' confidence and understanding mathematics. Table 4.4 describes the outcome of the questionnaire responded by the teachers.

Table 4.4: Duration in Teaching Mathematics

Sn	duration(years)	Frequency
1	Less than 2 years	0
2	Between 2-4 years	3
3	More than 4 years	17

Majority of the teachers, 17 (85%) have been teaching mathematics for more than 4 years, while 3 (15%) of the teachers said that they had been teaching the pupils mathematics between the 2 to 4 years. None of the respondents has taught mathematics

television programs. The rest of the teachers 13 (65%) responded that they had not seen any digital content for mathematics. This may be attributed to the fact that the government is not fully committed to invest in ICT at the primary school level.

Table 4.6: Knowledge of IT

S/N	Response	Frequency	Percentage
1	Yes	7	35.0
2	No	13	65.0
Total		20	100.0

4.9 Understanding of IT

Figure 4.2 below shows how the teachers rate the digital content found IT. The results were as follows: 9(45.0%) said that the digital media was excellent for facilitating knowledge, 7 (35%) said that it was good for facilitating knowledge, while 4 (20%) of the respondents said that it was fair in facilitating knowledge to the pupils.

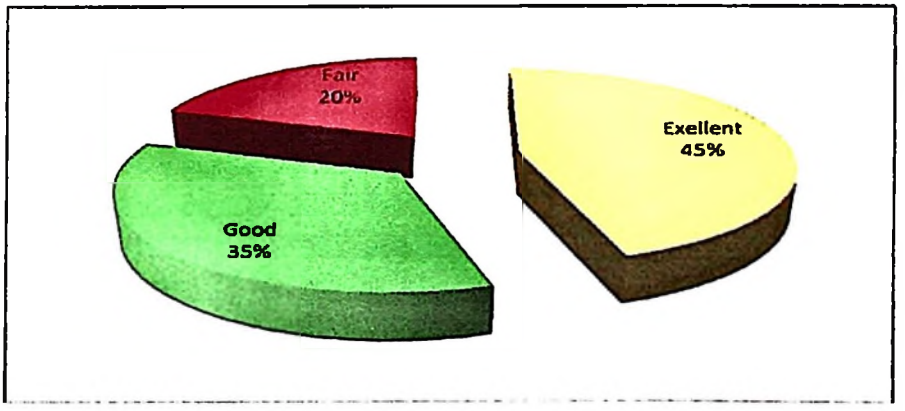

Figure 4.2: Understanding of IT

4.10 Inclusiveness of the digital contents in primary school curriculum

From Table 4.7 the results were as follows: 12 (60%) teachers said they would prefer digital contents to be included in the primary school curriculum, 2 (10%) teachers said they are against it while 6 (30%) teachers were not sure if digital contents should be included in the primary school curriculum or not. For those who were against, the reason behind may be that they compared the digitized contents with the ones they see on television programs.

Table 4.7: Inclusiveness of the digital contents in primary school curriculum

S/N	Responses	Frequency	Percentage
1	Preference of digital media	12	60.0
2	Against digital media	2	10.0
3	Undecided	6	30.0
Total		20	100.0

4.10.1 Impact of the digitized contents if included in the curriculum

Of those who said that they preferred the inclusion of digital media in the school curriculum, further stated that having digital contents in the curriculum would have the following impacts: 7 (58.3%) teachers said it would be very useful, 3(25%) said it would be useful to some extent and 2(16.7%) said it would be slightly useful.

Table 4.8: Impact of the digitized contents if included in the curriculum

S/N	Response	Frequency	Percentage
1	Useful	7	58.3
2	Somehow useful	3	25.0
3	Not useful	2	16.7
Total		12	100.0

4.11 Teachers' advice to the government

Of those who preferred the digital contents to be included in the primary school curriculum, 8(66.7%) of them said it should be included immediately since it will have an immediate impact towards learning and it will allow even other schools who do not possess computers to learn from those who do possess, while 4 (33.3%) of them said it should be included in the coming years to allow for amendments of the contents and allow other schools to possess computers. Of those who opposed stated that pupils are not mature to do multiple tasks like opening the computer, closing and opening files and dealing with the keyboards and mouse at once, listening and concentrating.

Table 4.9: Teachers' advice to the government

S/N	Response	Frequency	Percentage
1	Included immediately	8	66.7
2	Should be included later	4	33.3
Total		12	100.0

4.12 Pupils' behavior during presentation sessions

Pupils' behaviors were observed during each presentation and during question discussions. The aim was to determine their interest rate in mathematics. Two factors were taken into consideration which were:

i. To what extent were the pupils attentive during each presentation? (This was determined through the facial expression from each pupil, activities they were doing whether they relate to the subject matter).

ii. To what extent were the pupils active during discussions? (This was determined based on how a pupil was sharp in attempting the questions and cooperates with his/her group members).

Table 4.10 shows the outcome results.

Table 4.10: Pupils' behavior during presentation sessions

S/N	LESSON	VA	ATSE	LA	NAAA
1	Addition	8	6	5	1
2	Subtraction	10	1	7	2
3	Multiplication	4	8	4	4
4	Division	6	9	2	3

During the course of the session the following were deducted:

Pupils were VA for 28/80*100=35% of the time.

Pupils were ATSE for 24/80*100=30% of the time.

Pupils were LA for 18/80*100=22.5% of the time.

Pupils were NAAA for 10/80*100=12.5% of the time.

Indicators of VA included:

Facial expressions of the pupils such as getting excited, paying attention by constantly looking towards the video and not sideways, being active during the sessions by answering the questions asked by the presenter in the video.

4.12.1 Factors that reduced full activeness of the pupils

Busy with windows calculator: Initially when the computers were turned on in the first session, some pupils were engaged themselves playing with the windows calculator. While some were partially engaged, others were fully engaged. Few were partially looking sideways or busy with something else.

Busy with the keyboard: In the second session these PCs were turned off to avoid the distractions brought above. Despite all that pupils were now playing with the keyboard. Again while some were partially engaged, others were fully engaged. Few were looking sideways.

Busy chatting: In the third session pupils were more engaged in talking to one another. While some were fully engaged, others started sleeping but not heavily. Few were looking sideways.

4.13 Extent to which the pupils were active during their discussions

Questions were presented to each group and given the option to attempt them or leave them. Thereafter they were left alone for 5-7 minutes to be observed to each pupil's response. If a pupil attempts his/her question to a reasonable degree, he/she would be considered to be active, if she/he attempts his/her question and participates in helping others, he/she would be considered to be very active, if she/he attempts partially, he/she

would be considered to be very least active and if he/she does not attempt at all then he/she would be considered to be not active at all.

Table 4.11: Pupils' behavior during question sessions

S/N	LESSON	VAc	AcTSE	LAc	NAcAA
1	addition	10	7	3	0
2	subtraction	7	6	5	2
3	multiplication	7	10	2	1
4	division	12	5	3	0

Deductions:

Pupils were VAc for 36/80*100=45% of the time.

Pupils were AcTSE for 28/80*100=35% of the time.

Pupils were LAc for 13/80*100=17.25% of the time.

Pupils were NAcAA for 3/80*100=3.75% of the time.

4.14 Quiz results

After answering the second questionnaire, pupils were given short quiz comprising of twelve (12) questions after two days to determine if pupils really understood the digitized contents. Table below shows the summary results.

Table 4.12: Quiz results

S/N	Topic	Correct procedures and answers	Wrong procedures and/or answers	Percentage (%) of correct procedures and answers
1	Long form numbers	40	0	100.0
2	Addition	23	17	57.5
3	Subtraction	29	11	72.5
4	Multiplication	37	3	92.5
5	Division	42	38	52.5

The table 4.11 reveals that 71.25% of the questions asked were done correctly applying the taught tricks. Removing the first listed topic, only (131/200)*100%=65.5% of the questions asked would be considered to be done correctly. This may be attributed to the fact that pupils spent most of the time being active and attentive during the representations and doing questions.

4.15 Mathematics books used

Mathematics books used in Morogoro municipal are slightly different from other regions from other zones. According to Mr. Mtega, the mathematics teacher at Chief Albert primary school states that "each zone uses published books from different assigned vendors." The reason behind is so that every book suppliers get a share of selling their books. He states that "though different suppliers are involved in supplying books to different zones, the difference in the contents prepared by these suppliers is very minor."

4.16 Teaching methods

He also stated that "the teaching methodology used by teachers has not changed and basically remains the same where a teacher would enter a class of an average size of 80 pupils, deliver the prepared contents through chalkboard, ask some few questions and gives homework". He acknowledges that this approach does not encourage pupils to be

active enough. Though the schools possess computers, they are not used in teaching mathematics; rather they are used for teaching computer lessons (TEHAMA).

4.17 Computer training

Most of the teachers claimed that they do not get invited to computer training programs frequently and do not know why since as far as they know is that the government has put emphasis on ICT but has poorly failed to implement it. Some claimed that they have never attended any.

4.18 Reasons for rapid failure in mathematics

Teachers claimed that several reasons contribute to the failure of pupils especially in mathematics. Some blamed the government for not handling the complaints brought forth by the primary school teachers thus causing demoralization in their job performance, others said the curriculum should be renovated and others claimed that parents are not cooperating enough with school teachers to maximize pupils' potential. One teacher brought forth a challenge saying that find out how many parents supervise their kids to study after school hours in the night.

4.19 Document review

The reviewed curriculum does not encourage innovative teaching using computerized teaching aids either. Rather it emphasizes on chalkboard teaching where a teacher would enter the class, give a 40 or 80 minute session which the researcher believes this is a long time for a pupil to grasp everything in 80 minutes session. Thereafter a teacher gives worked example to 60-80 pupils or so and provides homework. Overall this

approach encourages memorizing and does not involve team work for pupils to exchange ideas. As a result slow learner pupils would be at a disadvantage.

The books reviewed were excellent for learning and they were above standard. But its major problems are that they lack sufficient diagrams for further elaborations. Also they do not contain little tricks that may give an extra edge to pupils in understanding mathematics. It is known that children cannot learn comfortably using books alone rather they need other constructive means such as animations which is possible through computers or manual drawings. Again slow learner pupils would be at a disadvantage.

These missing details were the major reason for the researcher to include computerized tricks as part of teaching sessions.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the conclusion of what has been discussed in chapter four. It further provides recommendation for the use of ICT through tricks and techniques to enhance the understanding and enjoyment of mathematics in primary schools.

5.2 Conclusion

This study was meant to create a computer model that will enable pupils to learn and understand mathematics. Overall it has shown that if well modeled, it can have a positive impact.

From the finding of the study through the use IT media such as using the computer and video, the subject of mathematics can be understood and enjoyed by the pupils.

Another finding from the study was that the teachers who are teaching mathematics to the pupils have the experience but still they lack the imagination to try new methods of teaching in order to make educational learning fun.

The study has also found that when pupils are introduced to different tricks and techniques then they are able to better understand the subject content which they are being taught.

For this enjoyment and understanding to occur then the teachers as well as various educational stakeholders must come together and provide the right learning environment for the pupils.

5.3 Recommendations

The utility of any research lies mostly in the conception of the research findings and then putting it into use. If the research findings cannot be put into any use desired, then the whole research exercise will be meaningless and the research finding can be termed as mere waste of material. The research findings cannot be put into use unless the researcher recommends to and directs these recommendations to the desired audience.

The following are the measures recommended to be taken to reduce the existing problems.

Through globalization, use of technology is increasing. It is now possible to deliver training and teaching to a widely disperse audience by several technological means. Despite of all this, only very few primary schools in the country are utilizing ICT into their teaching activities due to lack of electricity and adequate buildings. Meanwhile, this study has shown that ICT can have a positive impact to pupils if well in cooperated into the curriculum lesson. Thus the need for further development and use of ICT learning facilities at the lowest level to start with is highly recommended.

The government should in collaboration with relevant stakeholders select the most appropriate models suitable for Tanzanian learning environment. These models can enhance effective learning and produce better mathematicians to compete at global level.

However, we should not forget the fact that not every teacher is capable of applying the use of these models during lessons. Therefore, it is recommended that employers of teachers and the government should provide on-going in-service training on ICT. The teachers should participate with enthusiasm and partner with organizers to expand the tenure of such training or workshops. The ministry of education and local government education authorities should provide computers and other ICT infrastructure in all the government primary schools so as to encourage teachers to be trained in the school centers and to use them.

5.4 Areas for further studies

The study suggested the following topics for further research

1. An assessment of the methods of teaching mathematics should be done to understand whether it is a factor in the performance of mathematics.
2. An analysis of whether there is any correlation between the performance of mathematics and other subjects being taught at primary level.
3. A study should be done to determine the types of curriculum relevant for the use of ICT in lower classes in teaching various subjects.
4. To formulate computer program(s) that will enable pupils to interact with each other in a competitive manner from different areas around Tanzania.

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LISTOF APPENDICES

APPENDIX-1 Questionnaire 1 (to be filled by pupils before the study sessions)

Dear Sir/ Madam

My name is Mr. Mgeni, a student pursuing a Masters degree at the University of Dodoma (UDOM). I am undertaking a research on the topic **"Using Computerized Teaching Tricks for Learning and Understanding Mathematics in Primary Schools"**. This part is a part of my course for the fulfillment of the award of Master of Science in Computer Science. You are kindly requested to participate in this study and respond to this questionnaire for this purpose. All the information you will provide will be strictly kept confidential and only be used for academic purposes. I thank you for your cooperation and purpose.

1. . What is your sex? (Taja jinsia yako)

MALE (MWANAUME) [ ] FEMALE (MWANAMKE) [ ]

2. Do you like mathematics? (Je unalipenda somo la Hisabati?)

Yes (NDIYO) [ ] No (HAPANA) [ ]

3. Why do you like it/hate it? (Kwa nini unalipenda/unalichukia?)

_____

_____

4. Have you ever been taught mathematics using digital content notes before?(je ushawahi kufundishwa hisabati kwa njia ya kompyuta?)

YES (NDIYO) [ ] NO (HAPANA) [ ]

APPENDIX-2: Questionnaire 2(to be filled by pupils after completion of the study)

1. We learnt alternative techniques and tricks of adding whole numbers. In your opinion, have these tricks been of help or not? (Tumejifunza mbinu mbadala ya kujumlisha namba nzima. Kwa maoni yako je mbinu hiyo imekuwa na msaada kwako au la?)

Ndiyo, imekuwa na msaada sana. [ ]

Ndiyo, imekuwa na msaada kiasi. [ ]

Hakuna jipya nililojifunza. Njia zote kwangu ni sawa. [ ]

Hapana, mbinu mbadala ni ngumu kidogo kuliko mbinu za kawaida. [ ]

Hapana, mbinu mbadala ni ngumu sana kuliko mbinu za kawaida. [ ]

2. We learnt alternative techniques and tricks of subtracting whole numbers. In your opinion, have these tricks been of help or not?(Tumejifunza mbinu mbadala ya kutoa namba nzima. Kwa maoni yako je mbinu hiyo imekuwa na msaada kwako au la?)

Ndiyo, imekuwa na msaada sana. [ ]

Ndiyo, imekuwa na msaada kiasi. [ ]

Hakuna jipya nililojifunza. Njia zote kwangu ni sawa. [ ]

Hapana, mbinu mbadala ni ngumu kidogo kuliko mbinu za kawaida. [ ]

Hapana, mbinu mbadala ni ngumu sana kuliko mbinu za kawaida. [ ]

3. We learnt alternative techniques and tricks of multiplying numbers using few steps. In your opinion, have these tricks been of help or not?(Tumejifunza mbinu mbadala ya kuzidisha namba nzima. Kwa maoni yako je mbinu hizo imekuwa na msaada kwako au la?)

Ndiyo, imekuwa na msaada sana. [ ]

Ndiyo, imekuwa na msaada kiasi. [ ]

Hakuna jipya nililojifunza. Njia zote kwangu ni sawa. [ ]

Hapana, mbinu mbadala ni ngumu kidogo kuliko mbinu za kawaida. [ ]

Hapana, mbinu mbadala ni ngumu sana kuliko mbinu za kawaida. [ ]

4. We learnt alternative techniques and tricks to recognize if a number is divisible by another number, have these tricks been of help or not? (Tumejifunza njia fupi ya kutambua kama namba inagawanyika na namba nyingine bila baki au la. Kwa maoni yako je mbinu hizo imekuwa na msaada kwako au la?)

Ndiyo, imekuwa na msaada sana. [ ]

Ndiyo, imekuwa na msaada kiasi. [ ]

Hakuna jipya nililojifunza. Njia zote kwangu ni sawa. [ ]

Hapana, mbinu mbadala ni ngumu kidogo kuliko mbinu za kawaida. [ ]

Hapana, mbinu mbadala ni ngumu sana kuliko mbinu za kawaida. [ ]

5. To what extent have you understood the taught contents?(ni kwa kiasi gani somo limeeleweka kwa ufundishaji huu?)

Well understood (nimeelewa sana) [ ]

Slightly understood (nimeelewa kiasi) [ ]

Did not understand a bit (sijaelewa kiasi) [ ]

Totally did not understand (sijaelewa kabisa) [ ]

6. What is your overall view on the techniques/tricks used in teaching mathematics? Nini maoni yako ya jumla kuhusu mbinu za ufundishaji huu wa hesabu?

APPENDIX-3: Questionnaire 3(to be filled by teachers after viewing the contents)

Dear Sir/ Madam

My name is Mr. Mgeni, a student pursuing a Masters degree at the University of Dodoma (UDOM). I am undertaking a research on the topic **"Using Computerized Teaching Tricks for Learning and Understanding Mathematics in Primary Schools"**. This part is a part of my course for the fulfillment of the award of Master of Science in Computer Science. You are kindly requested to participate in this study and respond to this questionnaire for this purpose. All the information you will provide will be strictly kept confidential and only be used for academic purposes. I thank you for your cooperation and purpose.

1. How long have you been teaching mathematics?

2. Mention the tricks and techniques which you have been using to make mathematics easy and interesting for pupils to understand.(fill on the back page if space is not enough)

3. Mention where you get these tricks if they are available. Books [ ] Internet [ ] others (specify) [ ].....

4. Have you ever seen digital content notes being used in teaching and learning in primary schools in before? Yes [ ] No [ ]

5. How do you find the digital contents? Excellent [ ] Good [ ] Fair [ ] Poor [ ] Worse [ ] Worst[ ]

6. Do you think these digital contents should be included in the primary school curriculum? Yes[ ] No[ ] Not sure[ ]

7. If the answer is yes then what impact do you think this model will have on pupils' interest towards learning mathematics?

   Very useful [ ] Useful to some extent [ ] slightly useful [ ]

8. What are your suggestions to the government on the use of this model in teaching and learning in Tanzania primary schools? (nini ushauri wako kwa serikali juu ya ufundishaji wa namna hii wa kutumia kompyuta na kufanya maswali?)

APPENDIX-4: Interview guide

Dear Sir/ Madam

My name is Mr. Mgeni, a student pursuing a Masters degree at the University of Dodoma (UDOM). I am undertaking a research on the topic "Using Computerized Teaching Tricks for Learning and Understanding Mathematics in Primary Schools". This part is a part of my course for the fulfillment of the award of Master of Science in Computer Science. You are kindly requested to participate in this study and respond to this questionnaire for this purpose. All the information you will provide will be strictly kept confidential and only be used for academic purposes. I thank you for your cooperation and purpose.

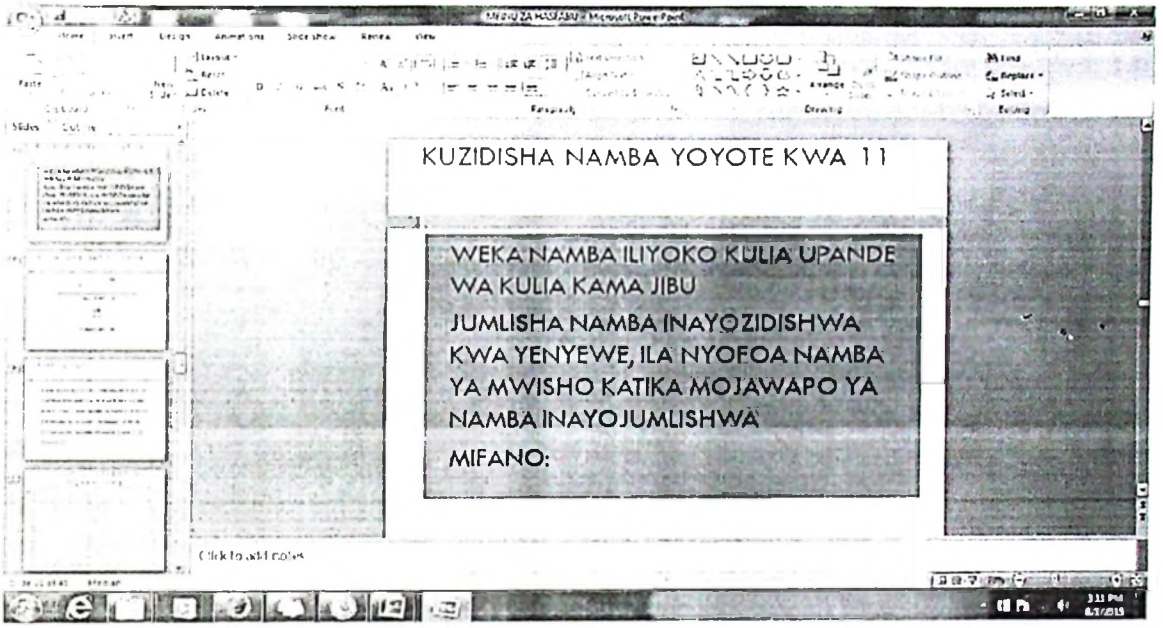
1. What Mathematics books are used in your school?

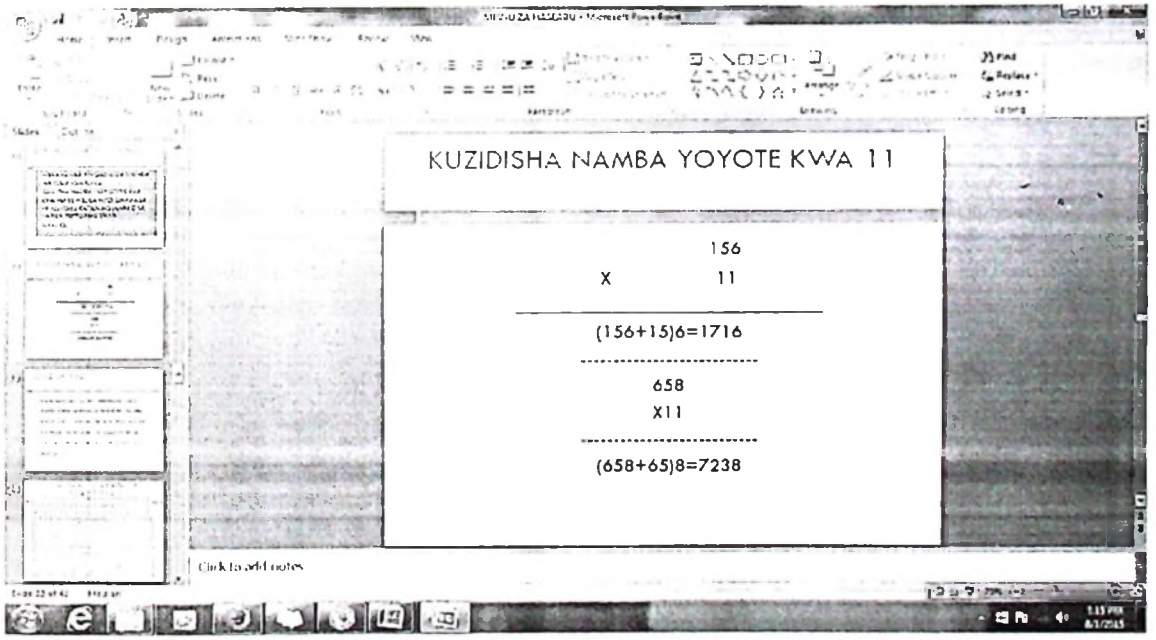
2. What are the teaching methods used to teach pupils mathematics?

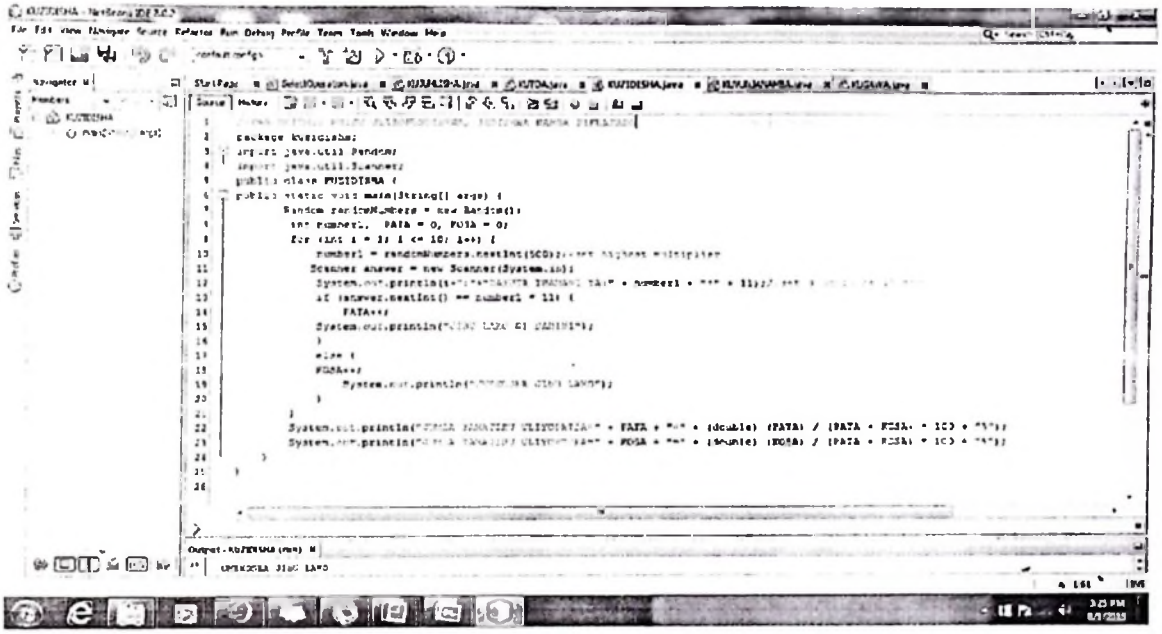
3. Have you ever been trained on any computer application programs? If yes when was the last time?

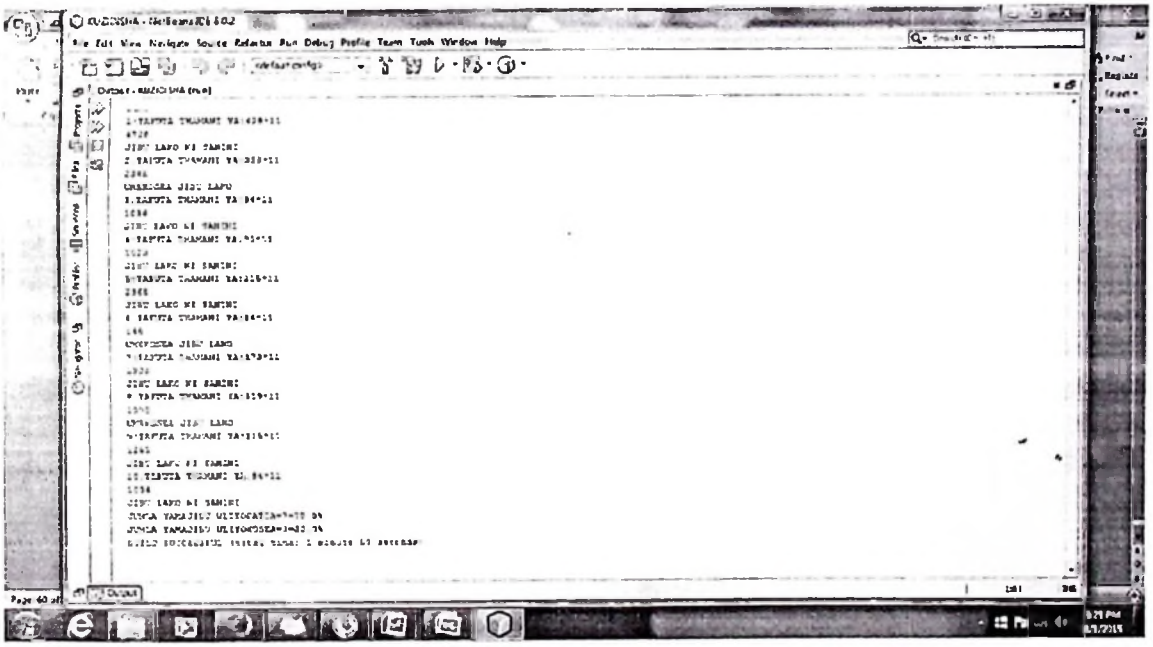
4. Why do you think pupils fail much in mathematics?

APPENDIX-5: Samples of the digitized Contents

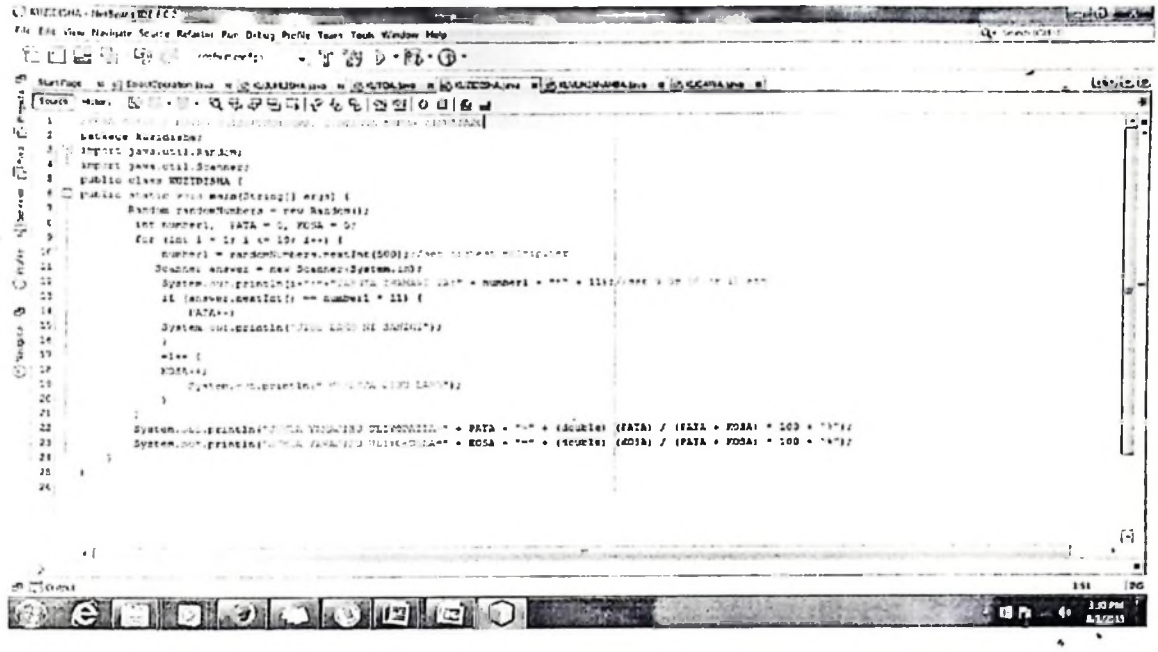








APPENDIX-6: Sample Java code for the Exercises



APPENDIX-7: Sample learning tricks used in mathematics

To multiply any number by 9:

Step 1: subtract the other number by itself

Step 2: add a 0 to the number on the right hand side

step3: complete the solution

Example: 46x9

1. 46-46
2. 460-46
3. 414

To multiply any number by 11:

1. right the last number that is not 11 on the right hand side of the answer
2. add the remaining part of the number by itself on the left hand side
2. remove one of number on the right hand side from 2
3. complete the operation

Example: 11x23

1. 3
2. (23+23)3

3. (23+2)3

4. 253

To recognize if a number is divisible by 3

1. add the numbers that is used to divide by 3

2. continue adding until a single digit is obtained

3. if the obtained number in 2 is divisible by 3 then the number in question is also divisible by 3

Example 4721/3

1. 4+7+2+1=14

2. 1+4=5

3. Since 5 is not divisible by 3 then 4721 is not divisible by 3