Sub-Sahara African Academic Research Publications
June, 2022 Editions

JESTP
Journal of Educational Studies, Trends and Practice.
Vol.24, No.8, ISSN 2285-8565

FACTORS AFFECTING THE USE OF COMPUTER IN TEACHING MATHEMATICS IN SECONDARY SCHOOLS IN JALINGO LGA, TARABA STATE, NIGERIA.

***DR. ABIGAIL SETH KARFE; **AYUBA IBRAHIM; & ***CLEMENT VAKANG TARI**
**Department of Guidance and Counseling, Taraba State University, Jalingo.*
***Department of Computer Science, College of Education, Zing, Taraba State.*
****Department of Mathematics and Statistics, Taraba State Polytechnic, Jalingo Campus, Taraba State, Nigeria.*

Abstract
The study investigated factors affecting the use of computer in teaching and learning mathematics in secondary schools in Jalingo LGA. Three objectives and three research questions were raised to guide the study. The study used the sample of 180 respondents that cut across students, mathematics teachers and school administration in all the selected schools. Questionnaire was developed and validated by expert academics which was the source of data collection. Mean and standard deviation were used to answer the research questions, the results showed that lack of availability of mathematics software, inability of teachers to handle the computer software to teach mathematics, lack of power and technical knowhow constitute the factors affecting the use of computer to teach mathematics in secondary schools. The study therefore, recommends that education stakeholders in the country should finance provision of computers, power generator, mathematics computer software, and expand computer laboratories in all secondary schools. This will enhance the use of computers in the teaching and learning of mathematics. All mathematics teachers should be trained on using computers to teach mathematics due to lack of computer skills. The government should make curriculum re-design of the mathematics syllables to accommodate the use of computer in the teaching and learning of mathematics.

Introduction
In today's classroom setting it seems like teachers are constantly battling with technology in their classroom. Technology has revolutionized the way teachers teach and students learn. If you are teacher in this 21st century, you will discover

that it has become a huge pain to get students off their smart phone or computers and get them to pay attention to the lesson. All you can see on top of their hands while they text and post on social media during classroom situation aren't the topic you currently teaching them. Lucky enough there is a way to incorporate that same technology that is distracting your students into classroom environment and use it to enable them learn better by employing educational Technology.

Educational technology is an interdisciplinary field which is comprised of a diverse set of disciplines and knowledge domains (Bhagwan, 2005). It is mainly concerned with the use of various forms of instructional modes that aids in simplifying abstract concepts during the teaching and learning process. Computer assisted learning (CAL) refers to the use of a computer as an instructional material in the teaching learning process. In the process, the teacher gives leaners computer directions in a programming language, use the computer as a tool using in-built software such as word processors and spread sheets or as a tutor the learners take drills, practice, tutorial, use exploration tools or simulation, and at times test using the computer (Deepark& Turner, 2006).

Audio-visual education a branch of education technology emerged as a discipline in the 1920s, when film technology was developing rapidly (Hughes, 1962). A visual instruction movement arose, which encouraged the use of visual materials to make abstract ideas more comprehensible to students. As sound technology improved, the movement became known as audio-visual instruction. Educators at that time viewed audio-visuals only as aids to teachers.

Not until world war //, when the armed services used audio visual materials to train large numbers of persons in short periods of time, did the potential of these devices as primary sources of instruction become apparent (Blomeyer and Martin 1991). In the 1950s and 60s, developments in communications theory and systems concepts led to studies of the educational process, its elements, and their interrelationships (Hughes, 1962). Among these elements are the teacher, the teaching methods, the information conveyed, the materials used, the student, and the student's responses. As a result of these studies, the field of audio visuals shifted its emphasis from devices and materials to the examination of the teaching learning process. The field was now known as audio visual communications and educational technology, and audio-visual materials were viewed as an integral part of the educational system (Laswell, and Dwight, 1948).

As the technology improved, educational capabilities increased correspondingly. According to Deepark and Turner (2006), the emergence of inexpensive computer technology and mass storage media, including optical videodiscs and compact disks, has given instructional technologies better tools with which to work. Compact disks (the CD-ROM and CD-I) are used to store large amounts of data, such as encyclopedias or motion pictures. In the new interactive delivery stations with computers and CD-ROM, CD-I, or videodiscs, a student who is interested in a particular topic can first scan an electronic encyclopedia, then view a film on the subject or look at related topics at the touch of a button (Garrison & Anderson, 2003). These teaching stations combine the advantages of reference materials, still pictures, television, and computer-aided instruction. With even newer technologies now being developed, such learning stations are now common place in homes for both entertainment and educational purposes. According to Nievergelt (1996) in Hung and Khine (2006); the appearance of microcomputers has initiated graphic animation and implementation of an increased variety of instructional strategies, such as simulation and modeling. Significant CAL project emerging from these efforts in the early 1970's included the Programme Logic for Automatic Teaching operations (Sherwin, 1978).

Various authors documented the immense benefits that these materials bring to the classroom. For instance, Porzio (1995) in a research finding published in Hung and Khine (2006) asserts that calculus students who used mathematical (a mathematics software) were better able to make connections between numerical, graphic and symbolic representations than students learning via traditional methods such as lecture method, historical method, book and pencil exercises and teacher centered teaching. The assertion is supported by the Roddick, (1995) in Hung and Khine (2006) who found that engineering mechanics students who used mathematical solved problems requiring calculus more conceptually when compared to students learning via traditional methods such as lecture method, historical method, book and pencil exercises and teacher-centered and mathematical wave equations (trigonometry iii) are embedded teaching focusing only on the procedures.

Snir (1996) (as cited in Hung and Khine, 2006) argues that computers can make a unique contribution to the clarification and correction of commonly held misconceptions of phenomenon by visualizing those ideas. For instance, he suggests that the computer can be used to form a representation for the phenomenon in which all the relational and mathematical wave equations

(trigonometry iii) are embedded within the program code and reflected on the screen by the use of graphics and visuals. Such use, according to Anderson, Boyle and Yost, (1986) in Hung and Khine (2006) makes the computer an efficient tool to clarify scientific understanding of waves and other mathematical topics.

Although there are numerous research on the positive impacts of computer-Assisted Learning (CAL) in foreign countries and higher institutions of learning including institutes of technology. Polytechnics and universities in Nigeria the high school mathematics teachers have done very little to introduce the same in their classroom teaching and learning process. With Government Day Secondary Education provided by the Nigeria Government, secondary schools are increasingly acquiring computers for science subject which is an optional subject, thereby ensuring that the infrastructure is put in place awaiting implementation (MOEST, 2003-2004).

It is common knowledge that mathematics and sciences subjects (biology, chemistry and physics) are a thorn in 'flesh' of most high school student in Nigeria (Chiriswa, 2002; Kwaka, 2003). This fact is illustrated by the persistent poor performance by most of the students in the subjects. The dismal performance, according to most researchers could be attributed to teacher factors, and inadequate access to or use of instructional materials among others (Ogembo, 2012).

B.F. Skinner's (1950) concept of programme instruction emphasized the need for total educational plan involving, identifying objectives; arranging subject matter into logical sequences; preparing and testing instructional programmes; and then implementing, testing, and revising them. Skinner shifted the emphasis in education away from the teacher's presentation of information and toward the learner's behaviour and, especially, reinforcement of that behavior. His teaching machines provided programme instruction, which allowed students to proceed through lessons by small steps, at their own pace, following an orderly sequence, and receiving immediate reinforcement for every correct response. Skinner's work emphasized the use of audio-visuals, which are well-illustrated in facilitating individualized learning. This is the concept that computer use in the teaching and learning mathematics was hope, would bring to the Nigeria classroom sessions. Therefore, the study investigates factors affecting the use of computer in teaching and learning mathematics in secondary schools in Jalingo Local Government Area, Taraba State.

Statement of the Problem

Mathematics has been recognized worldwide over the ages of civilization as a vital tool for survival, particularly in areas of science and technology. Mathematics education therefore has increasingly become science and technological oriented. The 21st century has witnessed an advanced development in information communication technology (ICT) through the introduction of Undersea Fiber Optic cables (UFOC) which links the whole world through the computer (internet), making the world a global village (Deepark and Turner, 2006). Further to these, there has been an increase in access to computers due to tremendous advancement witnessed in computer hardware and software engineering which has resulted in the lowering of the prices of desktop and laptop computer (Garrison and Anderson, 2003). Due to initiative of the government of Nigeria through the Ministry of Education and other stakeholders, there has been massive rollout of computer hardware and software to learning institutions (MOEST, 2003-2004). This rollout, it was hope would enable the learners in using the computers during their learning sessions, but unfortunately learners in the study area as observed are contrary with the rest of the developed world which constitutes the problem of the study.

Education sector professionals were particularly keen to adopting the technology of using computers in teaching and learning particularly of mathematics and sciences due to insight on its benefits in educational media instructions. Empirical data from researchers such as, Nievergelt (1986) in Hung and Khine (2006) and Bollinger (1986) have documented many potential benefits of using computers in mathematics education, an area that has presented a lot of challenges to learners particularly at the secondary school level. However, information obtained from most learners and their teachers in secondary schools particularly in Jalingo Local Government Area, Taraba State indicates that most schools are yet to integrate the use of computers in teaching and learning of mathematics, which constitute the problem of the study.

Purpose of the Study

The overall objective of this study was to investigate the factors affecting use of computers in teaching and learning mathematics in secondary schools in Jalingo Local Government Area, Taraba State.

The specific objectives of the study were to;

1. Find out the current status of computer models and mathematics computer software resources in secondary schools in Jalingo LGA, Taraba State.

2. Establish the difficulties teachers face when using computers in teaching and learning mathematics in secondary schools in Jalingo LGA, Taraba State.
3. Establish the challenges students face when using computers in learning mathematics in secondary schools in Jalingo LGA, Taraba State.

Research Questions

1. Do models of computer and mathematics computer software are available for use in secondary schools in Jalingo LGA, Taraba State?
2. Do teachers face difficulties when using computers in teaching and learning mathematics in secondary schools in Jalingo LGA, Taraba State?
3. Do students face challenges when using computers in learning mathematics in secondary schools in Jalingo LGA, Taraba State?

Methodology

Research Design: Descriptive survey research design was used for the study. It is survey research because information and data were mostly generated via the use of primary source specifically by the use questionnaire from representative sample of the population and the results were generalized to the entire population of the study.

Population of the Study: the population of the study was focused on public and private secondary schools in Jalingo Local Government Area of Taraba State. The total population of the study was 65,452 students in both private and public secondary schools in Jalingo. The population was gotten from individual school record.

Sample and Sampling

The sampling technique adopted for this study was proportionate sampling. The main purpose for using this sampling technique was as a result of school population so as to compose a sample that will yield effective outcome that can be generalized to larger society the higher the population the higher the sample and vice versa. Therefore, based on the technique used, fifteen (15) secondary schools were selected. Ten (10) students were selected from each school, a principal from each school (15) and all mathematics teachers available in the selected school which gives the total sample of 180 respondents.

Instrumentation: The instrument used for data collection were the questionnaires. This was based on the nature of the research work. The questionnaires were designed in three categories, that is, part one was for the students, part two was for the teachers and part three was for the principals. All the three categories of the questionnaires were divided into two sections, the bio-data and study items. The bio-data required the personal information of the respondents while the study items sought the information on the issue under study. Four point scale was used for the study (strongly agreed 4, agree 3, disagree 2, and strongly disagree 1).

Validation of the Instrument: The validity of the instruments was determined by the type of items in the questionnaires. The questionnaires have carried all the details items regarding the research topic, objectives and research questions for validation. Again, the questionnaires were proof read by the supervisor to ascertain the face validity of the instrument while, two experts from Faculty of Education, Department of Educational Foundations and Science Education Department to ascertain the content and construct validity of the instrument. All suggestions, observations and adjustment were made in line with the dictate of the validates.

Reliability of the Instrument: The instrument was subjected to a trial testing on twenty [20] students, five [5] teachers two [2] principals from the selected schools to determine the chances of incurring error before the main research work test-retest method of reliability was used to ascertain the consistency score of items by test takers using the interval of two weeks. The data were subjected to statistical analysis of Pearson product moment correlation coefficient and 0.75 value was obtained, which makes the instrument reliable for research purpose.

Method of Data Collection: Three sets of questionnaire were used for data collection. The distribution, administration and collection of the information were done by the researchers themselves wait and take approach was used for data collection which avoided missing questionnaire. The total of 180 questionnaires were retrieved from the respondents. The researchers used their identification cards before having access to valuable records and respondents in all sample schools.

Method of Data Analysis: The data generated from the respondents were only analyzed by the use of descriptive statistics, specifically by the use tables with figures and percentage, bar chart and pie chart.

Data Presentation, Interpretation and Analysis

Data Presentation and Analysis

Question1:

Research Question One: Do models of computer and mathematics computer software are available for use in secondary schools in Jalingo LGA, Taraba State

S/N	Item	Mean	St.D	Decision
1.	My school has computer laboratory	3.262	0.91	Accepted
2.	Students use computer to solve mathematics problem	1.024	1.94	Rejected
3.	I always feel comfortable to use computers to solve mathematical problem	1.13	1.72	Rejected
4.	I encounter problem when using computer to learn mathematics	0.62	1.43	Rejected
5.	I find mathematics easy when teachers use computer to teach	1.20	0.63	Rejected
6.	School authority take good care of computer resources	2.86	0.72	Accepted
7.	School computers not properly managed by the school authority	1.29	0.53	Rejected

Mean magnitude2.50

Based on the analysis of data the calculated means and standard deviation values indicate clearly that computer models and mathematics software are not available in secondary schools in Jalingo local government area, on the basis of data the research question that asked do models of computer and mathematics software are available for use in secondary schools in Jalingo LGA, Taraba State is no. Meaning schools in Jalingo LGA have no adequate computer and mathematics software for learning mathematics.

Research Question Two: Do teachers face difficulties when using computers in teaching and learning mathematics in secondary schools in Jalingo LGA, Taraba State?

S/N	Item	Mean	St.D	Decision
1.	Students enjoy learning mathematics in computers	1.90	1.32	Rejected

2.	Learning mathematics using computer in faster than manual means	1.30	1.46	Rejected
3.	Teachers talk little when teaching mathematics with computer	2.84	0.74	Accepted
4.	Students are eager to be in mathematics class because of the use of computer in teaching and learning the subject	1.41	0.93	Rejected
5.	Using computer to learn mathematics makes students solve other computer problems with less difficulty	1.76	1.69	Rejected

Mean magnitude 2.50

Based on the mean and standard deviation values, the data indicated clearly that teachers of mathematics find it difficult to teach mathematics using computer software because of the non availability of computer models and mathematics software in secondary schools of Jalingo LGA on the basis of the data research question that asked do teachers face difficulties when using computers in teaching and learning mathematics in secondary schools in Jalingo LGA, Taraba State is yes. Which shows that teachers face difficulties using computer software to teaching mathematics because of the non availability of computer models for mathematics software and lack of technical knowhow among the mathematics teachers.

Research Question Three: Do students face challenges when using computers in learning mathematics in secondary schools in Jalingo LGA, Taraba State?

S/N	Item	Mean	St.D	Decision
1.	Lack of adequate computer resources constitutes a challenge in learning mathematics using computer in my school	4.06	0.84	Accepted
2.	Teachers computer literacy constitutes a challenge in learning mathematics using computer	2.96	1.42	Accepted
3.	Problem of power constitutes a challenge in using computer to learn mathematics	3.63	0.86	Accepted
4.	Problem of computer management constitutes a challenge in earning mathematics using computer	2.03	1.06	Rejected

Mean magnitude 2.50

Based on the mean and standard deviation values, which indicated clearly students face challenges when using computer to learn mathematics. On the basis of data, which shows that students face difficulties in learning mathematics with computer. The research question that asked do students face challenges when using computers in learning mathematics in secondary schools in Jalingo LGA, Taraba State, is yes because of non availability of computer resources and mathematics teachers proficiency to teach students with less difficulties.

Discussion of Findings

The first finding of the study revealed that secondary schools in Jalingo LGA do not have computer software to teach mathematics in secondary schools. Based on the data generated, majority of the schools have computer laboratory to ensure teaching and learning mathematics. As a result, many of the students do not acquaint themselves with the computer only few make use of computer. The study was able to find out that students are not comfortable when using computer to solve mathematical problem. The student explained that lack of power, inadequate of computer machines etc were problems they encountered when making use of computer. Despite the availability of computer laboratory in some schools, the study was able to find out that the students do not have access to mathematics-computer software in learning mathematics.

Another finding of the study revealed that teacher face difficulties when teaching mathematics with computer software this shows that so many data were gathered in this respect and the study revealed that there is no availability of some computer facilities in most of the schools. This has been affecting teaching and learning mathematics in the schools. All the computer facilities were inadequate and bad condition. The computer machines, mathematical software, electrical supply, computer books and computer accessories were not adequate in bad condition. The study on the other hand has found out that there is no budget preparing for computer and mathematics software acquisition. Teachers do not mostly use computer to teach mathematics in spite of the availability of computer machines and computer laboratory. The study unveiled that lack of enough computer machines in some schools, lack of computer teachers, problems of power supply were the major factors affecting the use of computer in teaching and learning mathematics.

Another finding of the study revealed that students face challenges when learning mathematics using computer software the study have found out that the ministry

of education and secondary education board were having the responsibility to provide/supply computer and computer software in schools to enhance teaching and learning mathematics. However, some of the schools do not have computer and mathematics teacher as this affects the teaching and learning of mathematics and computer. The few mathematics and computer teachers in some schools have do not even make use of the available computer to teach their students. In other to ensure availability of computer in schools, the study revealed that the state government should make policy on the use of computer in secondary education and make it mandatory, also adequate fund needs to be released to procure such facilities. Finally, the challenges usually face in management of computer in secondary school is the problem of power supply, lack of teachers, as well as poor computer education.

Conclusion

Based on the findings of the study, the study concludes that secondary schools in Jalingo LGA do not have availability of computer software to teach students mathematics. Also mathematics teachers in secondary schools in Jalingo LGA have difficulties in using mathematics software to teach mathematics subject which has contributed the backwardness in using the software to teach the subject, despite the non availability of the software. Students also, have challenges in learning mathematics using mathematics software despite non availability of computer resources and lack of technical knowhow to master the skills to teach mathematics using computer software which has aggravated the difficulties in the side of the learners. The factors that affect teaching of mathematics using computer include; lack of availability of mathematics software to teach mathematics, lack of mastery of computer software to handle the subject using computer and lack of power and technical knowhow to support the availability of computer resources in secondary schools in Jalingo LGA.

Recommendations

The following recommendations were provided by the researcher based on the findings of the study;

1) Education stakeholders in the country should finance provision of computers, power generator, mathematics computer software, and expand computer laboratories in all secondary schools. This will enhance the use of computers in the teaching and learning of mathematics.

2) All mathematics teachers should be trained on using computers to teach mathematics due to lack of computer skills.
3) The government should make curriculum re-design of the mathematics syllables to accommodate the use of computer in the teaching and learning of mathematics.

References

Arnold (2007). Computer-Aided instruction at http:/ www. ima. Umn.Edu/~arnord/papers. Pdf.

Ayot, H.O (1984). Language for learning. Kenya publishers, Nairobi

Ball, D. (1986). Microcomputers in Maths Teaching. Anchor Brendon Ltd. London Bhagwan, D. (2005). Educational uses of information and communication. Encyclopedia of Educational techniques and methodology. Anmol publication, New Delhi Blomeyer, R.L. and Martin, D.C (1991). Case studies in computer Aided Learning. Falmer Press, London.

Bloomfield, (1975) Continuous Assessment in the certificate of Secondary education opinion and practice. Falmer press, London.

Bollinger (1986), Case studies in computer Aided Learning. Falmer press, London. Carrington, E.W. (1993). The future of education in the Caribbean: Report of the Caricom Advisory Task Force on education. Evaluative Report, ERIC database.

Checkpoint (2008). Kenya launches E-learning in schools. Retrieved October 24, 2009 from htt://www.checkpointelearning. com/article/4892.html.

Chariswa, P. (2002). An investigated into the probable factors responsible for poor Performance in Kenya Certificate of Secondary Education (KCSE) in Vighiga District of Western Province, Kenya. Unpublished master's thesis, Kenyatta University, Nairobi.

Clarke, L (2007). Exploring the use of computer technology in a Caribbean context; views of Pre-service teachers. International journal of education and development using information and communication technology, vol 3, issue 1, pp23-38. At ijedict.uwi.edu/include/gettdoc.php?id 2195&article

Crook, C. (2005). Computers and the collaborative experience of learning. MacKay's of Chatham plc. London.

Deepark. K. and Turner. J. (2006). Education for the 21st century-impact of ICT and digital resources. Springer. Santiago.

Dwyer. H and Margot Critchfield (1975) Computers and the collaborative experience of learning. MacKay's of Chatham plc. London.

Education and manpower Bureau (1998). Information technology for learning in a new era: five-year strategy 1998/99 to 2002/03, November 1998. Education and new manpower bureau, the Hong Kong: SAR Government, Hong Kong. Eshiwani, G.S (1981). The death of New Mathematics. The Kenya teacher, Nairobi Esmond, S, (2011, 14th June) computers for schools a boost to ICT. Daily Nation. Farrell. G. (2007). ICT in education in Kenya. Retrieved October 20, 2009 from htt://www.ifodev.org/en/publication409html.

Finger, G, Russell, R., & Russell, G. (1999). "Information technology and Australian teachers: Real time: Computers, change and schooling—National sample study of the information technology skills of Australian school students." Paper presented at the Australian Association for Research in Education and the New Zealand Association for Research in Education joint meeting. Retrieved November 4, 2011, from http://www.aare.edu.au/99pap/fin99548.html

Garrison. R and Anderson. T. (2003). E-Learning in the 21st century, a framework for research and practice. Taylor & Francis publishers. Rutledge.

Gay. R. L (1992). Educational research: competencies for analysis and application, 4th Ed. MacMillan. New York.

Hadley, M., &Sheingold, K. (1993). Commonalities and distinctive patterns in teachers' integration of computers. American Journal of Education, 101,261-315.

Hamner. M. (1974), Mathematics in Secondary Schools: A Teaching Approach. Cambridge University Press, London.

Hazewinkel. L and Michiel. A (2001). Mathematical induction, Encyclopedia of mathematics, Springer. Dordrecht.

Holland, S. (2002). Teaching math with technology. Media & Methods, 38, 14-16.

Howe, J.A and Ross, P.M (1981). Microcomputers in secondary education; Anchor. London.

Hughes. J.L. (1962). Programmed instruction for schools and industry. S.R.A Inc. publishers. Chicago

Hung, D. and khine, M.S (2006). Engaged learning with Emerging Technologies. Springer, Dordrecht.

Indulge, F. & Gatumu, H. (1996). Essentials of educational research. Nairobi: East African Publishers.

Karanja. D. (2013, 22nd April-3rd May). Using technology to support conceptual teaching and learning of mathematics and science. Kenyatta. University newslett. P3

Karanja. D. (2011). E-learning readiness in public secondary schools in Kenya: The case of Nakuru Municipality. Kenya. Unpublished MED thesis in the school of education of Kenyatta University, Nairobi.

Kieren. L (1973) Mathematics in Secondary Schools: A Teaching Approach. Cambridge University Press, London.

Kwaka, K, (2003): Influence of Teacher' Assessment practice in E nhancing performance in mathematics among Secondary school students in Mombasa District, Kenya. Unpublished MED project. Kenyatta University, Nairobi.

Laswell, Harold Dwight (1948). The structure and function of Communication in Society. Lyman Bryson. New York

Mahapatra. B.C. (2005). Information Technology and Education. Sarup& Sons Ltd, Delhi.

Miller, E. (1996). Partnership for change: Using computers to improve instruction in Jamaica's schools. Advancing basic education and literacy project. Academy for Education Development, Washington: D.C.

MOEST, (2003-2004). Annual Report; Directorate of Quality Assurance and standards, Nairobi.

Mondoh, H.O. (2005). Methods of Teaching Mathematics. Egerton University Press. Njoro, Mugenda, O.M and Mugenda, A.G (1999). Research methods: quantitative and Qualitative Approaches. Africa Centre of Technology Studies, Nairobi.

Mutula. S. (2003). The digital divide in sub-Saharan Africa: implications for revitalization and preservation of indigenous knowledge systems, paper presented at the SCECSAL-15 conference, 15-19 April 2002. Johannesburg.

NCTM (1991). Professional Standards for Teaching Mathematics, C.A. National Council of Teachers of Mathematics. Reston.

NCTM (2000). Underpinning the Principles and Standards for School Mathematics. National Council of Teachers of Mathematics. Reston.

Norton, S. (1999). Secondary mathematics teachers' responses to computers and their beliefs about the role of computers in their teaching. In J. M. Truran& K.M. Truran (Eds.), making the difference. Proceedings of the Twenty-second Annual Conference of the Mathematics Education Research Group of Australasia [MERGA] (pp.404-410). Adelaide, Australia: Mathematics Education Research Group of Australasia Inc.

Oduor H.N. (2009). The effects of strengthening of Mathematics and Sciences in Secondary education (SMASSE) training on performance of students in Chemistry in UasinGishu District, Kenya. Unpublished master's thesis, Moi University. Nairobi, Kenya

Ogembo, J.O. (2012). Determinants of student's poor performance in Chemistry in public schools of Kwale County, Kenya. Unpublished MED thesis in the school of Education of Kenyatta University of Nairobi.

Omwenga, I.E. (2005). Pedagogical issues and e-learning cases: Integrating ICTs into teaching and learning process. Paper presented at the School of Computing and Informatics University of Nairobi. Nairobi.

Orodho J.A (2005). Elements of Education and Social Science Research methods. Masola Publishers, Nairobi.

Orodho J.A (2004). Techniques of writing research proposal and reports in education and Social sciences, Masola publishers. Nairobi

Orton, A (1994). Issues in Teaching Mathematics, Cassell, London.

Pokay, P.A. &Tayeh, C. (1997). Integrating technology in a geometry classroom: issues for teaching. Computers in the Schools, 13(1/2). 117-123.

Robson, C. (2002). Real world research. A resource for social scientist and practitioner-researchers. 2nd Ed. Oxford, Blackwell publishing.

Scardamalia. M. (2004). CSILE/Knowledge forum. In educational technology: An encyclopedia. Santa Barbara.

Sherwin Gooch (1978). Plato music systems. Retrieved 2006-04-13

Siddiqui, M.H (2004). Challenges of Educational Technology. APH Publishing Corporation, New Delhi.

Skinner. B.F. (1950). Science and Human Behaviour .Octaviopaz publishers. London Small, David & Sandy (July 1984). Plato rising: online learning for Atarians.. Antic 3 (3). p. 36. Retrieved March 11, 2012.

Smerdon, B., Cronen, S., Lanahan, L., Anderson, J., Iannoti, N., Angeles, J., &Green, B. (2000), Sept.) Teachers' tools for the 21st century: a report on teachers' use of technology. Washington, DC: U.S. Department of Education.

National Center for Education Statistics (NCES). Retrieved September 17, 2011, fromhttp://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000102

Smith, Stanley, Sherwood, Bruce (April 1976). Educational uses of the PLATO computer system science. pp. 344-352. doi:10.1126/science. 769165. Retrieved March 11, 2012. Weiss. J. (2006). The International Handbook of Virtual Learning Environments. Springer, Dordrecht.

Wilson, M.R. &Krapfl, C.M. (1994). The impact of graphics calculators on students' understanding of function. Journal of Computers in Mathematics and Science Teaching, 13(2), 252-264

Willington, J. (2000). Contemporary issues and practical approaches. Continuum. London, Zammit, S. A. (1992). Factors facilitating or hindering the use of computers in schools. Educational research, 34(1), 57-66