



An Assessment on the use of Mathematical Softwares in Teaching and Learning of Mathematics in Colleges of Education in South-Eastern Nigeria: A Case Study of Anambra and Enugu

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Abstract

The study assessed the use of mathematical software packages (msp) in the Teaching and Learning of Mathematics in Government Colleges of Education in South Eastern Nigeria, particularly Anambra and Enugu. The research design was descriptive survey research design. The study was guided by five research questions and two null hypotheses. The population of the study was 337, which consisted of both lecturers and students from all the government colleges of Education in Anambra and Enugu; 41 from Enugu state college of Education Technical (Escet), 80 from Federal college of Education, Eha-Amufu, 116 from Federal College of Education (Technical), Umuoze and 100 from NwaforOrizu College of Education Nsugbe. Simple random sampling technique was used to select 200 students and lecturers for the study. The instrument for data collection was a structured questionnaire. To ensure the validity of the instrument the researcher submitted the questionnaire to two experts in mathematics and measurement and evaluation, in Nsugbe and Eha-amufu. The reliability coefficient was established as 0.72 using test-retest method. Mean and standard deviation was used to answer the five research questions, while chi-square was used to answer the two null hypotheses at 0.05 level of significance. The findings of this study among others showed that the use of msp in the teaching and learning of mathematics in colleges of education enhances/improves the understanding and study of mathematics. Also the improvement of the computer laboratories in mathematics department improves the use of msp in teaching and learning of mathematics. Recommendations made among others is that enough time should be allocated for the use of msp in mathematics time table.

Keywords: mathematical software packages (msp), colleges of education, descriptive Survey, Questionnaire, Teaching and Learning, chi-square.

Introduction

A lot of innovations have been integrated into college mathematics like set theory, numerical analysis, modelling, fluid mechanics, partial differential equation, abstract algebra, graphical representation, transformation, trigonometric, exponential and logarithm functions related calculation and problem solving, operations of matrix and determinant, vector, statistics and so on. These concepts are really difficult to teach by the help of board and marker hence varieties of digital devices can be used for its effectiveness. Several mathematics teaching related software or digital resources are available in the Internet. Each software has separate functions and applications. Teachers can choose any application/software on the basis of nature of their subject matter. Mathematics teacher can use digital resources in varieties of ways to support their teaching learning process, for that regard, they required high level of computer competency.

Today there are several popular technological tools that are widely used in mathematics education. A number of symbolic packages for mathematics courses are available such as MATHEMATICA, MATLAB or MAPLE, MAXIMA, SCILAB, SPSS, STATA, GAP, PSL, GEOGEBRA e.t.c., for education as well as research.

Okoye (2008) in her own contribution contends that mathematics is generally accepted as a foundation of science and technology. Mathematics is described as the queen of sciences, and the root of technological development. It was the light of this that Eraikhuemen (2003) opined that a second background in mathematics is a necessary condition for the study of science related subjects.

Many of the research report shows ICT is very supportive for teachers and students to learn mathematics easily and effectively. Dynamic software program, GeoGebra, support students' collaboration and creative reasoning during mathematical problem solving. Video classrooms, e-lesson preparation rooms, microteaching classrooms and Interactive Whiteboard for the training of teaching methods, become popular under multi-function classrooms. Computer software provides new opportunity to the teacher for better mathematics teaching. Pachemska et al (2014) found that mathematics achievement of ICT applied class students were very higher than other students. Sets, algebraic expression and logarithm can be effectively taught by using Algebra Solver Software, Algebra Helper, Cool Math, SOS mathematics, Web Math, Algebraic Info Mathematics.

Several technological tools should be managed in the classroom for mathematics teaching such as calculator and computer applications, presentation technologies, digital and mobile technologies, and the Internet. Drews (2007) mentioned some potential resources for mathematics teachings as manipulatives, images, mathematical games, worksheets, textbooks and everyday materials. Excel, Logo, Computer Algebra System, Databases Communication Facilities and Word Processing are general applications for mathematics and Even Derive, Mathematica, MathCad, MatLab, and Maple have included under Computer Algebra System.

Keong, Horani & Daniel (2005) found some softwares used by Mathematics teachers in teaching such as; processing packages, spreadsheets, search engines, presentation software and drill and practice software. Teachers have to maximize the input of ICT in mathematics teaching as an instructional tool, developing knowledge of different relevant software and multimedia, and incorporating the use of convenient ICT equipments in teaching practices. Logo, Computer Algebra Systems, Maths Curriculum Software, Interactive Whiteboard and Dynamic Geometry Systems were also highlighted as superlative tools for mathematics teaching. Scientific and graphic calculators and other subjective softwares are very beneficial for mathematics teaching. R. F. Church house et al. (1986) mentioned four types of computer implications in the mathematics classrooms as graphic possibilities, self-evaluation and individualized instruction, assessment and recording and students errors.

Mathematics Related Software

Several mathematics related softwares are available in the Internet; some of the common ones are Matlab, Mathematica, SPSS, Geogebra, and GAP. Others include ; Dynamic Algebra System, Graphing Calculator, Calc 3D Pro, Dynamic Omni Graph Evaluation, Cinderella 2, Graphers and so on related to mathematics. NCETM (2010) mentioned some useful software for college level mathematics teaching as; Acrobat Reader, Adobe (or another) SVG Viewer, Animation Software, Bowland Mathematics Materials, Data Logging Software, Digital Image Manipulator such as Picasa, Drawing Program, Equation-Editor as FX-Maths Pack, Internet Based Programs (EXP Maths 7, 8 and 9, Flash, java, Shockwave), Formulator Tarsia, geometry related software (Geometer's SketchPad, Cabri-Geometre or GeoGebra), Google Earth, graph drawing package (Omnigraph, Autograph, GeoGebra), graphic calculator, Interactive Whiteboard Software, Internet Browser (Plus Anti-Virus, Firewall, Anti-Spy-Ware Software), Mathematica Player, Media Player, Photograph and Music Compilation Software, Sound and Audio Editor, Spreadsheet, Statistics Software (Autograph, Fathom, Tinkerplots), TV access, Video Conversion Software, Virtual Manipulatives, Word Processor and YouTube.

Several software have been developed for the purpose of mathematics teaching which are separated under content free software which refers to commonly used softwares like writing software, art and design software, image editing software, multimedia authoring and presentation software, concept mapping software, database software and spreadsheet software, programming software, etc., and content rich software represents the specific software which can be used in mathematics teaching like as GeoGebra, Matlab, Maple, Mathematica. Math Type, Genius Maker Free Education, 3D Grapher, SPSS, Stata, Scilab, Graphic Calculator, Encarta, Microsoft Mathematics and so on.

A number of researches vividly pointed out the importance of mathematics softwares essentially, as it relates to inculcation of mathematical innovations and improvements among teachers and students. Mathematical softwares are established fundamentally to provide wide range of solutions to both simple and complex mathematics and physics problems in a fast and accurate manner. It encourages both individual and group usage. It encourages both teachers and students to spend less time in finding the solutions to problems rather to spend more time implementing the solutions already found. Teachers are expected to be abreast with the current and appropriate software packages to use that will be suitable and understandable at every level of their teaching bearing in mind the level of students they are teaching.

Statement of the Problem

Mathematics and Science students in general can only achieve their educational goal when there is provision of relevant resources, effective and efficient for their learning. Software packages are of great help in fulfillment of staff and students' educational needs. A well stocked computer laboratory in mathematics departments can make a difference in terms of school educational achievement and performance. Over the years there's been decline in the standard of mathematics being taught in colleges of education, especially in south-eastern part of Nigeria. The standard is dropping on a regular basis, and it has affected the quality of mathematics graduates being produced. This has been greatly attributed to the lack of ICT usage in the schools.

Angaye (2005) noted that the problem of information technology illiteracy was a serious one among teachers in the country as it cuts across primary secondary schools and tertiary institutions. He said that many teachers in the country did not have basic computer appreciation skills and noted that the problem was a hindrance to efforts at achieving the use of computers for educational purpose in schools. Busari (2006) is of the view that poor reading skills of science and technology students, the state of laboratory facilities, and dearth of science text books affect effective teaching and learning of science subjects.

Teachers' non-challantness to the use of ICTs in teaching mathematics has also contributed to the decline in the standard of education. According to Azuka (2003) the decline in the teaching of mathematics in colleges of education is highly contributed to the unavailability and use of technology in the teaching and learning process. This decline in the educational standard is not only affecting the colleges of education but also the basic and secondary schools as well. Because students at colleges of education are being trained to be teachers. Mathematics as a subject have evolved over the years, there has been a lot of innovations, improvements and developments. These changes include the introduction of Mathematical Softwares to mathematics

which most students and lecturers have not fully gotten acclimatized with and this in turn have reduced the academic standard of mathematics graduates especially in colleges of education.

Therefore, it is against this background, the researcher wants to investigate the availability, usage and effects of mathematical softwares in teaching and learning of mathematics in colleges of education in Anambra and Enugu.

Significance of the Study

The findings from this study will help the administration of the school system to come up with measures, policies that will bring about effective teaching and learning of mathematics in our colleges of education so as to improve the performance of students in mathematics.

The study when successfully completed will create in the teachers of mathematics the importance of the use of mathematics software packages towards effective teaching of mathematics.

The study will also create in the students of mathematics the pertinence of the use of these software packages in effective learning of mathematics. Thus, the students can then study and learn the subject on their own pace and with little or no assistance from the teachers, thereby reducing the problems encountered by lack of mathematics teachers.

The findings also serve as reference materials for further researches.

The study will also help learners in the study of other subjects effectively since mathematics is a pre-requisite in the study of sciences, social science, some vocational subject as well as technological courses.

The curriculum and education policy makers will also benefit from the result of the findings and will lay emphasis on the problems associated with the use of these software packages in the teaching and learning of mathematics in schools as well as ways of correcting them.

Research Questions:

The following Research questions will guide the study

1. To what extent is mathematical software packages used in the Teaching and Learning of Mathematics in colleges of Education in South Eastern Nigeria.
2. Does the use of Mathematical Software Packages enhance teaching and learning of mathematics in colleges of education?
3. What type of mathematical software packages are commonly used in teaching and learning of mathematics in colleges of Education in South Eastern Nigeria?
4. What factor hinders students and lecturers from having access to mathematical software packages?
5. Does the improvement of computer laboratories in mathematics departments enhance the use of Mathematical softwares?

Research Hypothesis

1. The use of Mathematical Software Packages does not enhance teaching and learning of mathematics in colleges of Education
2. The improvement of computer laboratories in mathematics departments does not enhance the use of Mathematical Softwares

Methodology

The study employed descriptive survey research design. The area of study is Anambra and Enugu State, Nigeria. The study covers all Government Colleges of Education in the two states. There are two government owned colleges of Education in Anambra State; NwaforOrizu College of Education Nsugbe, and Federal College of Education (Technical), Umuze. There are two government owned colleges of Education in Enugu namely; Federal college of Education, Eha-Amufu and Enugu state college of Education (Technical), Enugu. Private Colleges of Education was not be included. The population of the study was 337, which consists of both lecturers and students from all the government colleges of Education in Anambra and Enugu; 41 from Enugu state college of Education Technical (Escet), 80 from Federal college of Education, Eha-Amufu, 116 from Federal College of Education (Technical), Umuze and 100 from NwaforOrizu College of Education Nsugbe. Simple random sampling technique was used to select a sample of 200 lecturers and students for the study. The lecturers and the students are the respondents. Structured Questionnaires constructed in a 4-point Likert scale format was used as instrument for collecting data from the respondents. Mean and standard deviation was used to answer the research questions. Chi-square was used to test the hypotheses at 0.05 level of significance. The mean value of 2.50 and above was accepted while mean value below 2.50 was rejected.

PRESENTATION AND ANALYSIS OF DATA

Research Question 1: To what extent is mathematical software packages used in the Teaching and Learning of Mathematics in colleges of Education in South Eastern Nigeria.

Table 1: table 1 shows the responses of both lecturers and students on the extent mathematical software packages are used in the teaching and learning of mathematics in colleges of Education in South Eastern Nigeria.

S/N	Items	VO	O	R	VR	N	\bar{X}	S.D	D
1.	Mathematics Lecturers use mathematical software packages in the teaching of mathematics	20	35	50	95	200	1.9	1.02	Rejected
2.	Students practise/solve mathematics using mathematical software packages	18	28	63	91	200	1.87	0.97	Rejected
3.	Students use the computer lab in mathematics departments.	25	48	76	51	200	2.24	0.97	Rejected
4.	Enough time is allocated for the use of computer lab in the mathematics Time Table	24	21	88	67	200	2.01	0.96	Rejected

From table 1 above, we can see that the mean responses of both lecturers and students are below 2.50. This means that lecturers and students are of the opinion that mathematical software packages are not usually employed in the teaching and learning of mathematics.

Research question 2: Does the use of Mathematical Software Packages enhance teaching and learning of mathematics in colleges of education?

Table 2: table 2 shows the mean responses of both lecturers and students to whether the use mathematical software packages enhance teaching and learning of mathematics.

S/N	Items	SA	A	D	SD	N	\bar{X}	S.D	D
5.	Mathematical software packages makes solving mathematics easier	80	75	35	10	200	3.1	0.87	Accepted
6.	Mathematical software packages enables students to understand complex and difficult topics in mathematics better	70	85	20	25	200	3	0.97	Accepted
7.	Mathematical software packages offer the learners the opportunity to be creative, imaginative and positioned to acquire reasonable knowledge.	65	76	42	17	200	2.9	1.06	Accepted
8.	The use of mathematical software packages makes lecturers and students lazy	19	23	68	90	200	1.9	0.25	Rejected
9.	Mathematical softwares helps students to learn on their own and explore more topics and exercises	88	84	20	8	200	3.3	0.79	Accepted
10.	Mathematical softwares improves lecturers and students knowledge of computer and mathematics	79	81	18	22	200	3.09	0.94	Accepted
11.	The use of mathematical softwares improves implementation of results by reducing time and energy spent in finding the result	64	82	41	13	200	2.99	0.87	Accepted
Total		465	506	244	185				

From item 5,6,7,9,10,11 we can see that both lecturers and students are of the opinion that the use of mathematical software packages enhances the teaching and learning of mathematics. From item 8, we can see that both lecturers and students are not of the opinion that the use mathematical software packages make them lazy.

Research question 3: what type of mathematical software packages are commonly used in teaching and learning of mathematics in colleges of education in South Eastern Nigeria?

Table 3: table 3 shows the responses of both lecturers and students on possible types of mathematical software packages that are commonly used in teaching and learning of mathematics in colleges of education in south eastern Nigeria.

S/N	Items	SA	A	D	SD	N	\bar{X}	S.D	D
12.	MATHLAB/MAPLE	18	41	44	97	200	1.9	1.02	Rejected
13.	SCILAB	31	46	64	59	200	2.25	1.03	Rejected
14.	MATHEMATICA	26	24	70	80	200	1.98	1.02	Rejected
15.	GEOGEBRA	27	40	50	83	200	2.06	1.06	Rejected
16.	SPSS	40	46	51	63	200	2.32	1.11	Rejected
17.	STATA	19	18	43	120	200	1.68	0.98	Rejected
18.	GAP	12	14	66	108	200	1.65	0.85	Rejected

From table 3 above, all the items were rejected because their mean is less than 2.50. This means that both lecturers and students are of the opinion these Software packages are not consistently used in the teaching and learning of mathematics in colleges of Education.

Research question 4: what factors hinders students and lecturers from having access to mathematical software packages

Table 4: possible factors that hinders the effective use of mathematical software packages by both lecturers and students

S/N	Items	SA	A	D	SD	N	\bar{X}	S.D	D
19.	Inadequate maintenance of computer laboratories in mathematics departments	77	79	24	20	200	3.07	0.93	Accepted
20.	Unstable/Inconsistent power supply in the school	92	87	12	9	200	3.31	0.78	Accepted
21.	Insufficient modern computers in the computer lab in mathematics departments	100	70	17	13	200	3.29	0.85	Accepted
22.	Consistent upgrading/updating of the mathematical softwares to modern ones	20	24	66	90	200	1.87	0.98	Rejected
23.	Lack of lecturers' knowledgeability on the use of mathematical software packages in teaching mathematics	55	70	45	30	200	2.75	1.02	Accepted

From table 4 above, item 19,20,21 and 23 all have a mean rating of over 2.50, hence both lecturers and students are of the opinion that inadequate maintenance of computer labs, unstable power supply, insufficient modern computers and lack of lecturers' acquaintance with the softwares hinders them from having access to mathematical software packages. They are also of the opinion that consistent upgrading of mathematical software packages to modern versions is in no way a barrier for them in accessing and using the mathematical software packages.

Research question 5: Does the improvement of computer laboratories in mathematics department enhance the use of mathematical softwares?

Table 5: table 5 shows the responses of both lecturers and students to whether the improvement of computer laboratories in mathematics department enhances the use of mathematical softwares

S/N	Items	SA	A	D	SD	N	\bar{X}	S.D	D
24.	Adequate power supply to computer lab in mathematics departments will improve the use of mathematics softwares	81	82	13	24	200	3.1	0.97	Accepted

25.	Adequate supply of modern computer that are software package friendly will enhance the use of mathematical softwares	70	84	20	26	200	2.99	0.98	Accepted
26.	Involving an expert for periodic check of the softwares/computers to ensure their efficiency will improve the use of the softwares	90	61	40	9	200	3.16	0.9	Accepted
27.	Constant upgrading/updating of the mathematical softwares to newer versions in the computer lab will improve the use of mathematical software packages.	67	81	22	30	200	2.93	1.01	Accepted
Total		308	308	95	89				

From table 5 above, all the items were accepted. This means that both the lecturers and students are of the opinion that improvement of computer laboratories in mathematics departments will improve the use of mathematical software packages in teaching and learning of mathematics.

Research Hypothesis 1: The use of Mathematical Software Packages does not enhance teaching and learning of mathematics in colleges of Education

Table 6: summary of research hypothesis 1, using chi-square analysis.

Number of Students	DF	X ² Cal	X ² Crit	Level of Sign.	Decision
200	18	328.5614	28.869	0.05	Rejected

From table 6 above, the critical chi-square value at 18 d.f and 0.05 level of significance is 28.869, which is less than the calculated value (x^2_{cal}). Hence we reject the null hypothesis. Hence the use of mathematical software packages enhances teaching and learning of mathematics in colleges of Education.

Research question 2: The improvement of computer laboratories in mathematics departments does not enhance the use of Mathematical Softwares

Table 7: summary of research hypothesis 2, using chi-square analysis

Number of Students	DF	X ² Cal	X ² Crit	Level of Sign.	Decision
200	9	36.8959	16.919	0.05	Rejected

From table 7 above, the critical chi-square value (x^2_{crit}) at 9 d.f and 0.05 level of significance is 16.919, which is less than the calculated value (x^2_{cal}). Hence the null hypothesis was rejected. Hence the improvement of computer laboratories in mathematics departments enhances the use of mathematical softwares.

Summary of Findings

From the study, the following findings were made:

1. Mathematical software packages are not usually employed in the teaching and learning of mathematics.
2. The use of mathematical software packages enhances the teaching and learning of mathematics.
3. Mathematical software packages for colleges of education like SPSS, MATLAB, SCILAB, STATA e.t.c are not consistently used in the teaching and learning of mathematics in colleges of Education.
4. Inadequate maintenance of computer labs, unstable power supply, insufficient modern computers and lack of lecturers' acquaintance with the softwares hinders both lecturers and students from having access to mathematical software packages.
5. Improvement of computer laboratories in mathematics departments will improve the use of mathematical software packages in teaching and learning of mathematics.
6. The use mathematical software packages doesn't make lecturers lazy.

Discussion of findings

The findings in research question 1, shows that both lecturers and students accepted that mathematical software packages are not usually employed in the teaching and learning of mathematics. Findings from research question 2, shows that the use of mathematical software packages enhances the

teaching and learning of mathematics. The research hypothesis 1 was tested, and the result showed that mathematical software packages enhances the teaching and learning of mathematics in colleges of education. The findings from research question 3 clearly showed that the most common types of mathematical software packages are not consistently used in the teaching and learning of mathematics as seen from the responses of both the lecturers and students.

Findings from research 4, shows that Inadequate maintenance of computer labs, unstable power supply, insufficient modern computers and lack of lecturers' acquaintance with the softwares hinders both lecturers and students from having access to mathematical software packages. The findings from research question 5 revealed that, Improvement of computer laboratories in mathematics departments improves the use of mathematical software packages in teaching and learning of mathematics. Research hypothesis 2 was tested against research question 5. The result showed that Improvement of computer laboratories in mathematics departments will improve the use of mathematical software packages in teaching and learning of mathematics in colleges of Education.

Conclusion

The results drawn from this study has shown that mathematical software packages are seldomly used in the teaching and learning of mathematics in colleges of Education. Also the study showed that the use of mathematical software packages enhances the teaching and learning of mathematics in colleges of education in Nigeria. The study also revealed that the improvement of computer laboratories in mathematics departments will improve the use of mathematical software packages.

Recommendations

The following recommendations were made based on the findings:

1. Lecturers should take advantage of the ongoing in-service training on mathematical software packages (msp) by participating with enthusiasm and partnering with organizers to expand the tenure of such training or workshops
2. There should be steady supply of electricity in schools to enhance effective use of the computer laboratories in mathematics department.
3. Qualified computer technologist/analysts should be employed in colleges of education to assist the mathematics lecturers in using msp
4. Newer versions of the softwares should be regularly checked and updated for effective use.
5. Enough time should be allocated by the departments for msp training and usage in the time table.
6. Policy makers and curriculum planners should enhance the educational computer knowledge which is a viable option for improving the use of msp. This should be done through in-service training, workshops and conferences.
7. More funds should be provided by the government for procurement of modern computers, installation of modern versions of msp and maintenance of the computer laboratories in mathematics departments.

References

- Angaye D.A (2005). A study of causes of failure in mathematics at high school stage. *Academic Research International, Volume 4 No. 5. International Journal of Educational Studies in Mathematics, 2019, 6(1), 19-33*
- Azuka, D.S. (2003) *Journal of Educational Psychologist Volume 26, 3-4*
- Busari, N.G. (2006) Students' Perception of Teachers' Characteristics and their attitude Towards Mathematics in Oron Education Zone, Nigeria. *International Education Studies; 6(2)2013. 1913-9020.*
- Drews, D. (2007). *Using Resources to Support Mathematical Thinking, Primary and Early Years (Chapter 2.Do resources matter in primary mathematics teaching and learning?)*. Learning Matters Ltd. Retrieved from; <http://xtec.cat/centres/a8005072/articles/resources.pdf>
- Eraikhuemen, C.H (2003). Teachers' Qualification and Subject Mastery as Predictors of Achievement in Mathematics in Ibarapa Division of Oyo State. University of Ibadan. Ibadan Nigeria. Federal Republic of Nigeria (2013). *National Policy on Education*. Lagos: NERDC Press.
- Keong, C. C., Horani, S., & Daniel, J. (2005). A Study on the Use of ICT in Mathematics Teaching. *Malaysian Online Journal of Instructional Technology (MOJIT), 2(3)*, 43–51. Retrieved From file:///C:/Users/dirgha12/Downloads/A_Study_on_the_Use_of_ICT_in_Mathematics_Teaching.pdf
- NCETM (2010). *Mathematics and Digital Technologies New Beginnings*. National Centre for Excellence in the Teaching of Mathematics. A Report, September 2010. Retrieved <https://www.ncetm.org.uk/public/files/3399763/NCETMDigitTechReport2010.pdf>
- Okoye, M.B (2008). community involvement practice for facilitating secondary school administration in Enugu state. *Unpublished Ph.D. Thesis. UNN.*
- Pachemska, S., Pachemska, T. A., Iliev D. &Kuzmanovska, M. S. (2014). Analyses of student's achievement depending on math teaching methods. *Procedia - Social and Behavioral Sciences 116, 4035 – 4039*

R. F. Churchhouse et al. (1986). *The Influence of Computers and Informatics on Mathematics and its Teaching* 24-38. Cambridge University Press, Chapter DOI: <http://dx.doi.org/10.1017/CBO9781139013482.004>