International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979
Impact Factor: RJIF 5.72
Received: 05-06-2018; Accepted: 12-07-2018
www.allsubjectjournal.com
Volume 5; Issue 7; July 2018; Page No. 15-19

Availability and utilization of computer packages in learning of geometry in junior secondary schools in Port Harcourt metropolis

Charles-Ogan Gladys Ibibo[1], Amadi Joseph C[2]
[1] PhD. Department of Curriculum Studies and Educational Technology, University of Port Harcourt, Nigeria
[2] Department of Curriculum Studies and Educational Technology, University of Port Harcourt, Nigeria

Abstract
The study explored the availability and investigated the utilization of computer packages in learning of geometry in junior secondary schools in Port Harcourt metropolis. Descriptive survey design was used in carrying out this study. The population consisted of 2,547 JSS3 students in public junior secondary schools in Port Harcourt educational zone of Rivers State. Simple random sampling technique was used to get sample size of 220 JSS3 students (120 males & 100 females) for the study. Four objectives and four research questions guided the study. Frequency counts, percentages and mean were used to answer the research questions. Researchers-made questionnaire titled: Availability and Utilization of computer packages in learning of geometry (AUCPLG). was used for data collection. The instrument was face and content validated by three Mathematics experts. Reliability coefficient index of 0.85 was obtained using Pearson's Product Moment Correlation. The result revealed that the availability and utilization of computers and computer packages in the sampled junior secondary schools were inadequate. The result also revealed that students were motivated to learn geometry with the support of computer packages**.** Based on the findings, it was recommended that the government should ensure that Computers are adequately provided with all the required packages for teaching and learning of geometry and Mathematics teachers should endeavor to introduce the use of all the computer packages for learning geometry during instruction.

Keywords: availability, utilization, computer packages, learning geometry, junior secondary schools

Introduction

It is not an overstatement that geometry occupies a very significant and unique position in the secondary Mathematics curriculum, mainly due to the rich variety of concepts it comprises. Besides, it represents the abstraction of visual and spatial experiences like shape, measurement, mapping and pattern. Geometry is a key player in developing students' skills when it comes to problem-solving. The development and use of these skills and concepts occupy a very important position in the life of a student even after graduation from school. Furthermore, geometrical constructions and algebraic computations are involved in the productions of almost all objects of everyday life, take for example building up a house; constructing a bridge, a tower, a ship, and aircraft, a submarine, and so on.

Geometry has a good number of difficult concepts with connected networks, it also has cognitive, and illustration structures that are used to abstract and explore physical and imaged spatial environments (Battista, 2007). To learn geometry requires a lot of objects and structures of geometric concepts that make distinctions between these concepts. There is no gainsaying that geometry is a key subject which is not only studied in the school but which makes provision for students to develop appreciable knowledge of figures and their makeups. Besides, geometry aids learners to resolve significant issues as well as use geometric makeups in real-life examples. According to National Council of Teachers of Mathematics, (2000), one of the essential parts of looking at geometry is to use two or three dimensions of a geometric structure. With the rapid growth in the world today towards electronics, the use of Computer has been the major focus and teachers have been using the computer for many purposes beyond word processing.

The computer is a device that performs some intellectual roles with the aid of stored programme even beyond human capability. Oluwatayo (2012) defined the computer as a technological innovation under the control of stored programme that can perform some of the intellectual roles of man even beyond human capability. Abass (2010) defined a computer as a combination of related devices capable of solving problems by accepting data, performing described operations on the data, and supplying the results of these operations. The computer is used for games, word processing or accounting alone, it is a great tool for education for everybody, from children at the kindergarten to postgraduate students. The computer helps students to learn according to their ability; it saves time and also allows students to manage the pace and progress of their learning. It gives an appropriate reply, thus providing an extra useful effective atmosphere for slower learners. It monitors students' growth through the keeping of a record, provides dependable lessons for learners and also gives good training to learners.

Technology allows teachers to do many things that they could not ordinarily do or would be very hard to do manually. The

promise is that through using the particular software in carefully-designed ways, it is possible for learners to simultaneously use and come to understand important aspects of Mathematics, which otherwise will be impossible. One of the ways of providing for computer-based learning milieu structures is known as "direct manipulation" of mathematical objects and relations. It is true that appropriate use of technology makes provision for a beautiful environment where learners' geometric understanding can progress (NCTM, 2000). The question is how should these technologies be implemented and established in the Mathematics classroom? How much technology should be incorporated? What effects might such usage have on teaching-learning, and the curriculum? What is the risk of disregarding current technology within the Mathematics education community? Dimakos and Zaranis (2010) wrote: "We risk limiting students' mathematical power by divorcing Mathematics from technology. In order to derive maximum benefits from technology, it should be used on a regular basis. Technology should be used to make classrooms more active and dynamic, as well as to explore realistic applications where they can focus on important concepts rather than routine calculations. There is, therefore, the need to fix computers in all the classrooms. The NCTM (2000) in Dimakos and Zaranis (2010) suggested that computer software should be used in junior secondary one (JS1) to senior secondary three (SS3 for the promotion of inductive thinking among mathematics students. National Council of Teachers of Mathematics (2000) stated that in school mathematics tangible tools, illustrations are necessary to learn geometry. Soft wares such as Cabri, Geometry Inventor, Cinderella, Geometer's Sketchpad facilitate students' establishing relationship between geometrical shapes and making inferences.

There have been different types of computer software developed for use in Mathematics. Two of the widely used soft wares are Computer Algebra Systems (CAS) and Dynamic Geometry Systems (DGS). Computer Algebra Systems (CAS) focuses on how to manipulate symbolic expressions, Dynamic Geometry Systems (DGS) deals with relationships between points, lines, circle. During the preceding decade, graphing has also been integrated into CAS in order to visualize Mathematics; similarly, DGS has begun to include elements of algebraic symbolization in order to be useful for a wider range of mathematical problems (Hohenwarter, 2004). A major feature of DGS is the ability to allow the user to interact with the software and provide immediate feedback. Dynamic software ties Mathematics items to each other so that every alteration of a property of an item leads to a corresponding change of all related mathematical objects. In dynamic software, mathematical and concepts simulations of real-world problems that can be explored in a broader way compared to other learning situation. Other computer software developed for use in Mathematics are:

1. Computer-Assisted Geometry: deals with use computer program such as Geometer to solve geometric constructions.
2. Computer-Aided Proof: computer to search for the geometric theorem.
3. The Locus of Points Computer geometry program helps to solve problems on the locus of a point.
4. Projective Geometry Geometer

The study and practice of mental manipulation of pictures in the study of geometry are often much easier to understand by mentally manipulating the picture than by manipulating a formula algebraically. Mental manipulation of geometry is not easy for many people, but at present most new personal computers have graphical capabilities. These machines can help picture geometric results. With a computer program called Geometer, one can manipulate geometric diagrams.

There is no doubt that dynamic geometry software (DGS) aids learners to picture geometric models and understand geometric rules, generalizations and relationships between the concepts (Jones, 2000; Marrades & Gutierrez, 2000). Dynamic geometry software (DGS) does not only intensify learners' achievement but develop their geometric reasoning and problem-solving skills. Furthermore, DGS also facilitates learners understanding, proves hypotheses and inferences (Jones, 2000). Doing proofs entails making a good plan for proof (Heinze, Cheng, Ufer, Lin, & Reiss, 2008). The learners become better as they frequently use DGS to do basic constructions, and it helps them to appreciate what it takes to make correct constructions.

According to Dimakos and Zaranis (2010) using dynamic computer software (Geometer's Sketchpad) progresses learners' development of geometric thought when appropriately used who further reiterated further that using Geometer's Sketchpad will possibly simplify geometry instruction, as well as improve learners' interest thereby helping them overcome their learning difficulties.

Dimakos and Zaranis (2010) conducted a study on how computer technology and learners' gameness for self-directed learning are related using Geometer's Sketchpad; they posited that a positive correlation did exist between these variables due mainly to the students' (positive) attitudes towards the computer software. Dimakos and Zaranis (2010) also used Geometer's Sketchpad in doctoral studies to find out if computer used with inductive pedagogy increases learners' achievement in geometric. It was revealed that those learners who create and manipulate dynamic visualization of geometric structures on the computer screen comprehend concepts of geometry and absorb geometric skills with better retention. Other ways of using Geometer's Sketchpad are: construct figures, measure segments and angles, calculate expressions, and manipulate figures.

Given the importance of computer packages in learning Geometry, the researchers conducted this study to find out the number of available educational computer packages in learning of geometry in junior secondary schools in Port Harcourt metropolis of Rivers State and how they are used.

Statement of the Problem

Geometry is one of the branches of Mathematics. There are various topics that makeup geometry in Mathematics curriculum in the junior secondary schools in Nigeria. Like any other Mathematics topic, geometry is taught by recitation and memorization of definitions and formulae. Teaching and learning geometry in this way will not only put a limit to the students' capacity as it will not give the opportunity to totally comprehend the concepts of geometry but would not empower

them to solve conceptual problems differing from routine exercises. This could be among the reasons why students dread Mathematics. Besides, how can one expect a good performance from the students on exercises in which they have to justify the validity of given formulae or to solve conceptual problems? In the present circumstance, the researchers investigated the number of computer packages available and how they are used in learning of geometry in junior secondary schools in Port Harcourt metropolis of Rivers State.

Aim and Objectives of the Study

The aim of the study was to investigate the computer packages available and how they are used in learning geometry in Junior Secondary Schools in Port Harcourt metropolis, the specific objectives were to:

1. determine if there are computers in junior secondary schools (JSS);
2. ascertain if computer packages are in Junior Secondary Schools for learning Geometry;
3. determine the extent to which computer packages are being utilized to learn geometry in junior secondary schools; and
4. investigate the extent students are motivated to learn geometry with the support of computer packages

Research Questions

The following research questions guided the study:

1. How available are computers in junior secondary schools Port Harcourt Metropolis?
2. What are the computer packages available to aid the learning of Geometry?
3. What is the extent of the use of computer packages to learn geometry in JSS?
4. To what extent are JSS3 students motivated to learn geometry with the support of computer packages?

Methodology

The design of this study is a descriptive survey and it is basically exploratory. Descriptive research examines and explains conditions of the present situation of an issue so as to make decisions to improve the situation.

The population consisted of Two thousand, Five Hundred and Forty-Seven (2,547) JSS3 students in public junior secondary schools in Port Harcourt metropolis of Rivers State.

Simple random sampling technique and purposive sampling were used to get the sample of 220 students (120 males & 100 females) from six junior secondary schools in Port Harcourt metropolis of Rivers State.

Researchers-made questionnaire titled: Availability and Utilization of computer packages in learning of geometry (AUCPLG) was used for data collection. It was divided into four sections: A, B, C and D. Section A was concerned with the data needed on the availability of educational computer packages in learning of geometry in junior schools. Section B sought information on the use of educational computer packages in learning of geometry in JSS schools. Section C sought to know how often students learn geometry using computer packages. While section D obtained information on the extent JSS3 students have knowledge of the use of computer packages to learn geometry.

The instrument was face and content validated by three experts Curriculum Studies and the Educational Technology University of Port Harcourt. Test re-test method was used to determine the reliability of the instrument. The reliability coefficient of 0.85 was obtained using Pearson's Product Moment Correlation.

Results and discussion

The results of each question were presented on the different:

Research Question 1: How available are computers in junior secondary schools Port Harcourt metropolis?

Table 1: Percentage response of students on the availability of Computers in selected schools

	No. of Students	Percentage (%)
Available	98	44.5
Not Available	122	55.5
Total	220	100

***Source*:** Researchers' fieldwork (2017)

The data in table 1 shows that ninety-eight students representing 44.5% of the respondents maintained that computer was available in their schools while one hundred and twenty-two students representing 55.5% said that they are not available in their schools. This implies that over 50% of the students indicated that computers were not available in their schools.

Research Question 2: What are the computer packages available to aid the learning of Geometry

Table 2: Availability of computer packages and their adequacy relative to the students' population

S/N	Computer packages	Adequate		Inadequate		Unavailable	
		No of schools	%	No of schools	%	No of schools	%
1.	Geo Gebra	2	33.3	1	16.7	3	50.0
2.	Cabri Geometry	2	33.3	1	16.7	3	50.0
3.	Compass and Ruler (CAR)	5	83.3	1	16.7	0	0.0
4.	Asymptote	1	16.7	0	0.0	5	83.3
5.	Geometer's Sketchpad	3	50.0	1	16.7	2	33.3
6.	Cinderella	0	0/0	2	33.3	4	66.7
7.	Inkscape	3	50.0	0	0.0	3	50.0
8.	Sketchpad	3	50.0	1	16.7	2	33.3
9.	Live Geometry	0	0.0	2	33.3	4	66.7

10.	Dr. Geo	1	16.7	0	0.0	5	83.3
11.	The Locus of Points Computer geometry	1	16.7	1	16.7	4	66.7
12.	Computer-Aided Proof	3	50.0	0	0.0	5	50.0
13.	Computer-Assisted Geometry	3	50.0	2	33.3	1	16.7
14	Computer-Assisted Geometry	1	16.7	1	16.7	4	66.7

***Source*:** Researchers' fieldwork (2017)

Table 2 gives a summary of the data obtained from an analysis of computer packages and shows the level of availability and adequacy as outlined under each item. The results showed that 50% of the following items 1, 2, 7, and 12 were unavailable; 83.3% of item of item 4 was unavailable; 66.7% of items 6, 9, 11and 14 were unavailable; 50% items 5, 7, 8, 12 and 13 were adequate; 83.3% of item 3 was adequate.

Research Question 3: What is the extent of JSS 3 students' use of computer packages to learn geometry?

Table 3: Students' ability to use computer packages to learn geometry

S/N	Computer Packages	Able to use		Not able to use	
		No of students	%	No of students	%
15.	GeoGebra	76	34.5	144	65.5
16.	Cabri Geometry	40	18.2	180	81.8
17.	Compass and Ruler (CAR)	220	100.0	0	0.0
18.	Asymptote	10	4.5	210	95.5
19.	Geometer's Sketchpad	60	27.3	160	72.7
20.	Cinderella	05	2.3	215	97.8
21.	Inkscape	80	36.4	140	63.4
22.	Sketchpad	140	63.4	80	36.4
23.	Live Geometry	02	0.9	218	99.1
24.	Dr Geo	05	2.3	215	97.8
25.	The Locus of Points of Computer geometry	21	9.5	199	95.5
26.	Computer-Aided Proof	109	49.5	111	50.5
27.	Computer-Assisted Geometry	117	53.2	103	46.8
28.	Projective Geometry Geometer	54	24.5	166	75.5

***Source*:** Researchers' fieldwork (2017)

Results of the analysis of students' ability to use computer packages to learn geometry, on Table 3 shows that Compass and Ruler (CAR) is the most computer packages used to learn geometry (100.0%), by the sampled students, followed by Sketchpad and Computer-Assisted Geometry (63.4%) and (53.2.0%) respectively, then Computer-Aided Proof (49.5%). 99.1%, 97.8%, 97.8%, 95.5%, 90.5% of the sampled students were unfamiliar with the use of Live Geometry, Dr Geo, Cinderella, Asymptote and The Locus of Points of Computer geometry respectively. It is interesting to note that Cabri Geometry was (18.2%), Projective Geometry Geometer (24.5%) and Geometer's Sketchpad (27.3%) recorded very low rating with a majority of respondents indicating that they were not familiar with them. Furthermore, GeoGebra also recorded low rating of 34.5%. One could conclude that this is due to inadequate exposure of the students to proper computer packages experience that involves handling of all the required packages.

Research Question 4: To what extent are JSS3 students motivated to learn geometry with the support of computer packages?

Table 4: The extent of JSS3 students' motivation to learn geometry with the support of computer packages

S/N	Item Statements	SA	A	UN	D	SD	Mean	Std.	Decision
29.	I liked studying geometry lessons with computer software (DGS)	65	60	40	43	14	3.6	1.02	Accepted
30.	I prefer lessons with computer packages, not with the textbook.	40	55	65	60	0	3.3	0.96	Accepted
31.	Using computer packages motivates me to interact with my group mates and my teacher during lessons	20	86	53	31	30	3.2	0.82	Accepted
32.	I prefer solving geometrical problems with the use of computer package	15	70	66	40	31	3.0	1.31	Accepted
33.	I want to learn all geometry lessons with computer packages	23	68	76	35	18	3.2	0.91	Accepted
34.	Lessons with computers are Interesting to learn geometry	30	73	57	25	35	3.2	1.02	Accepted
35.	The DGS helped me a lot to learn the geometry concepts	13	31	50	60	66	2.4	0.65	Accepted
36.	Computer packages help each group to interacted with other groups and the teacher during lessons	45	40	70	24	41	3.1	1.01	Accepted

***Source*:** Researchers' fieldwork (2017)

The total numbers of respondents were 220; mean below 3.0 was rejected while the mean equal to or above 3.0 was accepted.

Table 4 gives a summary of the data obtained from an analysis of the extent JSS3 students were motivated to learn geometry with the support of computer packages. Items 29-34 and 36 with their weighted mean of 3.6, 3.3, 3.2, 3.0, 3.2, 3.2 and 3.1 respectively, show that the respondents agreed that they want to learn geometry with the use of computer packages. Item 35 with the weighted mean of 2.4 showed that the respondents

did not accept that the DGS helped them to learn the geometry concepts.

Discussion of Findings

Overall analysis of the data on the availability of computer packages and students' ability to use computer packages shows that most schools have no computer packages for learning geometry. The study revealed inadequacy in chemistry laboratories. This result revealed the inadequacy of the use of computer packages for the teaching and learning of geometry in the junior secondary schools.

Further, the findings showed that most of the students were not familiar with how to use most of the computer packages to learn geometry. The study further revealed that there are schools within Rivers State which to date still do not have computer packages in the junior secondary schools. It was also discovered that most of the schools selected lacked a computer. Computer and Computer packages availability is, therefore, one of the major causes of students' poor performance in geometry in junior secondary schools.

Summary of Findings

The study found that there are still some junior secondary schools which do not have computer packages for learning geometry. Only a few junior secondary schools among the 6 sampled could be said to have computers. Noticeably the students were motivated to learn geometry with the support of computer packages.

Conclusion

From the research findings of this study

Most junior secondary schools in Port Harcourt metropolis do not have adequate computer packages, and hence students are not adequately exposed to the use of computer packages in geometry instruction.

Recommendations

In the light of the above findings, the researcher wishes to make the following recommendations:

1. The government should ensure that Computers are adequately provided with all the required packages for teaching and learning geometry.
2. Mathematics teachers should ensure that students are introduced to the use of all the computer packages for learning geometry during instruction.

Implications of the Study

The findings of the study have some educational implications:

The use of Computer packages by Mathematics teachers' during their geometry classes will improve students' performance in geometry.

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