SENIOR SCHOOL STUDENTS PERCEPTION OF THE USE OF GEOGEBRA INSTRUCTIONAL PACKAGE IN LEARNING LINEAR EQUATIONS IN OGBOMOSO, NIGERIA

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Abstract: This study investigated the perceptions of secondary school students towards the use of GeoGebra instructional package in learning linear equations. The focus was on ease of use and usefulness of GeoGebra instructional package. Other variables investigated includes students' attitude and behavioural intentions towards the usage of GeoGebra. Four research hypotheses were generated and tested at 0.05 alpha level of significance. The study was a developmental research involving training of a group of senior secondary school one (SS1) students and determining their perceptions about GeoGebra. Questionnaire adapted from technology acceptance model was used to collect data. Cronbachalpha was used to determine the reliability coefficient which yielded 0.92. The data obtained were analysed using Pearson Product Moment Correlation statistics. The study revealed that the relationships between student's perception towards the ease of use and usefulness of instructional package, ease of use of geogebra instructional package and student's attitude, and student's attitude and behavioral intention of student about the use of geogebra instructional package were positively high (β=0.901, 0.811,0.842 &0.871) respectively. Based on the results, it was concluded that the attitude of students towards the use of Geolebra instructional package depend on their perceptions on its usefulness and its ease of use. Finally, it was recommended that GeoGebra package should be integrated into theteaching and learning of mathematics in secondary schools.

Keywords: GeoGebra, Attitudes, Behavioural intention, Perceptions, Instructional Package

Introduction

Mathematics is a mental activity which is essentially subject for every individual in this universe. The knowledge of Mathematics is a fundamental for problem solving, logical thinking and reasoning for daily basis. To excel well in Mathematics, high level cognitive processes such as critical thinking, reasoning and imagination are required. In this respect, using pencil, paper and board cannot be sufficient to cultivate those processes. Therefore, Mathematics should be approached with different types of learning methods where students can enhance their understanding and make the learning fun (Dogan & Icel, 2010; Hohenwarter & Fuchs, 2004).

Education system has begun to change very tremendously in the presence of Information and Communication Technology (ICT). Most countries have begun to integrate the use of ICT in their education system. The use of computers in teaching and learning has become a catalyst to positively change the approach to teaching and learning (Tella, Tella, Toyobo, Adika, & Adeyinka, 2007). The use of technology in education enhances the students learning and helps the educators to encourage a constructivist classroom environment (Muir-Herzig, 2004). Many computer applications have been developed explicitly to engage learners in critical thinking in the market, such as Mathematica, Matlab, Maple V, Geometers' Sketchpad, Autograf, Graphic Calculator and others (David, Chad, & Hsiu-Peng, 1998). These software tools can provide powerful symbolic and numerical calculations, can produce quick calculations and also assist students in abstract mathematical concepts (Hohenwarter, Hohenwarter, Kreis & Lavicza, 2008)). However, the use of any mathematical software such as the above requires high expenditure, should the government decideto implement it in all schools (Dogan & Icell, 2010). Fortunately, there is a software system called GeoGebra that inte- grates possibilities of both dynamic geometry and computer algebra in one programme for mathematics teaching (Hohenwarter & Jones, 2007; Dikovic,2009).

These materials are very concise, easily accessible, and professionally done, with supplementary suggestions contributed by users. This concerted assisted enviro nment is described as focusing on "quality versus quantity" in the GeoGebra website (Grandgenett, 2007).

GeoGebra is an innovative tool for integrating technology in teaching and learning mathematics. It was developed by Markus Hohenwarter in 2001 and can be freely downloaded from www.geogebra.org. ―This mixing of algebra and geometry is the heart of GeoGebra (Sangwin, 2007). This tool can motivate students to explore mathematics and offer opportunities for critical thinking, which is central to constructivist. Diković (2009) found that GeoGebra can help learners grasp experimental, problem-oriented and research-oriented learning of mathematics, both in the classroom and at home. This software can benefit students by enabling them to understand the ideas embedded in the theorems and problems more fully than they would have understood without the aid of technology (Pandiscio 2002). It was also found that the use of Geogebra enhanced the student's performance in learning mathematics (Saha, Ayub &Tarmizi, 2010, Shadaan & Eu, 2013; Zengin, Furkan, &Kutluca, 2012).

Although the integration of technology in mathematics learning has become very trendy, the effectiveness of technology in mathematics still remains a debatable issue in the board of education. To find a solution for the problem, the concrete reason behind this issue must be addressed first. It has been proved by many researchers that the students' attitude and perception are the backbone for the success of any instructional approaches or integration of technology in the educational system

(Alexiou-Ray, Wilson, Wright, &Peirano, 2003).Volk and Yip (1999), stated that to lead and forecast the upcoming actions, students' attitude and perception are playing a major function. In fact, the participation level of students in the society is affected by the negative or positive attitudes of students towards the technology.

Many studies have been conducted to determine the suitability or effectiveness of the use of computer software in teaching and learning mathematics. The results of using computers to assist in the instruction of mathematics have been mixed. Magallanes (2003) compared the use of Ethnomathematics software and the traditional method. The findings indicated that there were significant differences on the test scores between the two groups with students who used the Ethnomathematics software achieved higher scores. Teaching and learning of mathematics utilizing the graphing calculator was found to be instructionally efficient significantly, compared to the conventional and Autograph software (Aberson, Berger, Healy, Kyle,, & Romero, 2000). Mean while, findings ofSchpilberg and Hubschman (2003) indicated that the use of Gemeters Sketchpad (GSP) induced higher mathematical thinking process amongst the GSP group. These findings showed that the use of GSP had an impact on both mathematical thinking process and performance.

This work, therefore, makes a deep study on the students' attitudes towards the integration of GeoGebra technology in the learning of linear equations. In Nigeria's education curriculum, this topic is being taught in SSI. (Federal Ministry of Education, 2007).Many researchers have conducted researches on GeoGebra on attitudes towards the technology in education in many topics such as Geometry (Botana & Abánades, 2014), Intergers (Reisa, 2010), Trigonometry (Zengin, Furkan, & Kutluca, 2012), Calculus (Volk & Yip, 1999), Algebra (Hohenwarter & Fuchs, 2004; Hohenwarter & Jones, 2007). But researches on specific topics like linear equations still as countable as the fingers on one hand. The positive or negative attitude cum perceptions of students will determine the effectiveness of GeoGebra on learning the linear equations. The primary factors that are influencing the students' attitudes towards the use of GeoGebra in learning the particular topic can be identified by using the modified model from Technology Acceptance Model which was introduced by Davis in year 1989.

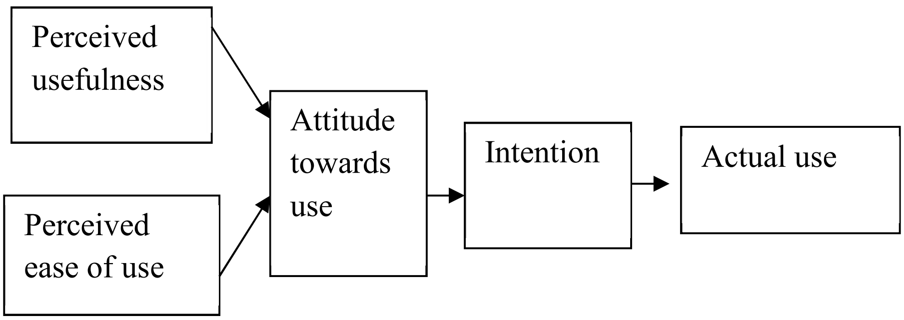

Figure 1: Technology Acceptance Model (TAM). Source: Ajzen (2006)

It is a model that explains factors that influence users' acceptance of technology systems. It is an adapted model of TRA. TAM ignores the role of normative beliefs and replaces behavioural beliefs about the outcome with Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). Perceived Usefulness is about the extent to which a person believes that using the technology will enhance his or her job performance while perceive ease of use is about a person's beliefs that using the specific technology will be free of effort (Ajzen, 2006 ; Davis, 1989). Venkatesh and Davis (2000) found that perceived usefulness is a strong determinant of users' intention.

Purpose of the Study

The aim of this study was to investigate the perceptions of senior secondary school students towards the use of GeoGebra instructional package in learning of linear equations.

Research Hypotheses

HO_1: There is no relationship between students' perception of the ease and usefulness of GeoGebra instructional package

HO_2 : there is no relationship between students' perception of usefulness GeoGebra instructional package and their attitude toward GeoGebra instructional package.

HO_3 perceived ease of use ofGeoGebra instructional package has no relationship with the attitude of students toward GeoGebra instructional package

HO_4: there is no relationship between students' attitude and behavioural intention toward GeoGebra instructional package.

Method

This study was a developmental research which involved training of students and measurement of their perceptions about theuse of GeoGebra instructional package. Developmental research has been applied to diverse areas of study and practice. It is a strategy for changing the beliefs, attitude and values of organization so that they can better adapt to new challenges (Bennis, 1969; Lieberman & Miller 1992,;Richey & Kelvin,2005)

This study involved an intact class of SS1 which was purposively selected. Having a functioning computer laboratory and being a co-educational school were used as criteria for selection. The sample size comprised 38 students. The lesson was made up of six periods. The researcher used the first two periods to introduce the students to the use ofGeoGebrainstructional package. Third to fifth periods were used to teach the students how to use GeoGebra to solve linear equations.The students were given notes (procedure) and worksheets at the end of each lesson. Also students were asked to do exercises using GeoGebrainstructional packages. The lesson was bi-directional, it was interactive, and students were encouraged to asked questions if they had doubt about the use of GeoGebrainstructional package. Finally, the last lesson was devoted for general discussion and questionnaire administration

Students' perceptions toward Geogebra questionnaire was used to collect data in this study.The instrument was divided into sections A, B&C.Section A is about the students' background (age, sex and prior use of GeoGebra).Section B contains items on the attitude and behavioural intention to GeoGebra.Section B was made up of 33 items.A 4-point likertt type was used to rate each item in section B. The items in section were based on four constructs in the technology acceptance model (TAM) section C contains open ended question which asked the students to provide answer at their own will.

Data Analysis

Data collected through questionnaire were analysed by SPSS 20.0. The hypotheses were tested by using Pearson correlation. The instrument was subjected to both face and content validity.test retest was used to test for its reliability. The score was later subjected to Cronbach alpha test of reliability. Cronbachalpha co-efficient obtained was 0.921 which indicated that the instrument was highly reliable.

Results

The results of the study are summarized in accordance to the hypotheses set for the study

$Ho_{1:}$ There is no relationship between students' perception of the ease and usefulness of GeoGebra instructional package.

The result table 1 shows that there was a strong and positive relationship between students' perceptions towards ease of use and usefulness of GeoGebra package. The calculated value was 0.90. Therefore, hypothesis 1 was rejected since p-value: 0.00 is less than 0.05 and β=0.90. Thus, there exists a significant relationship between students' perception towards ease of use and usefulness of GeoGebra instructional package.

HO_2: there is no relationship between students' perception of usefulness GeoGebra instructional package and their attitude toward GeoGebra instructional package.

The result in the table also revealed that there was a strong positive relationship between students' persived usefulness and their attitude towards the use of GeoGebra instructional package (β=0.811,p-value= 0.039 at 0.05). Maybe the students' positive attitude towards the use of GeoGebra is that students found GeoGebra beneficial for them to learn mathematics.

HO_3: Perceived ease of use of GeoGebra instructional package has no relationship with the attitude of students toward GeoGebra instructional package.

From the result in the table, it was revealed that students' perception about ease of use of GeoGebra instructional package has significant relationship with students' attitude towards the use of GeoGebrain learning linear equations. Since the p-value 0.029 was less than 0.05 while β= 0.842. Therefore, both usefulness and ease of useof GeoGebra have significant relationship with the attitude of students towards the GeoGebra in learning mathematics hencee, HO_3 was rejected.

HO_4: There is no relationship between students' attitude and behavioural intention toward GeoGebra instructional package.

The result in the table also showed that students who showed positive attitude to the use GeoGebra also showed positive behavioural intention to the use GeoGebra. Thus, HO_4 was rejected that is, there was a strong positive relationship between students' attitude and behavioural intention of students to the use of GeoGebra instructional package (β =0.971,p-value=0.000, at 0.005).

Table 1

Pearson Moment Correlation Coefficients Table

	Variables	**Sign. At 0.05**	Pearson Correlation	**Remark**
1	Ease and usefulness of GeoGebra	0.000	0.901	N/S
2	usefulness of GeoGebraand students' attitude	0.039	0.811	N/S
3	Ease of GeoGebra and students' attitude	0.029	0.842	N/S
4	students' attitude and behavioural intention	0.001	0.871	N/S

@ 0.05 level of significance

Discussion

The finding on the relationship existing between student's perception towards the ease of use and usefulness of GeoGebrainstructional package was strongly and prositively high (B=0.901). May be hand-on –design activities and examples adopted for training made the studenst to perceive that if GeoGebrapackage is easy to use it will be found useful for them to learn mathematics. The result agreed withBagozzi, Daris and Warshaw, 1992 &Dogan and Icel (2010) who stated that the greater the perceived ease of use and usefulness of an innovation is, the greater the likelihood o adopting the innovation .

Again it was found that students' perceptions about ease of use, usefulness and their attitude towards the use of GeoGebrainsturstional package in learning mathematics were highly related. Their attitude towards the use of GeoGebrapackage is determined by their perceptions on its usefulness and also how simple it is to use (Venkatesh & Davis (2000). Thus, the study agreed with the finding of Keringan (2002)&Wenglinsky (1998) who found that computer assisted instructions make students have positive attitude, build confidence in their ability to do mathematics, construct mathematics skills, promote higher order and improve mathematics achievement.

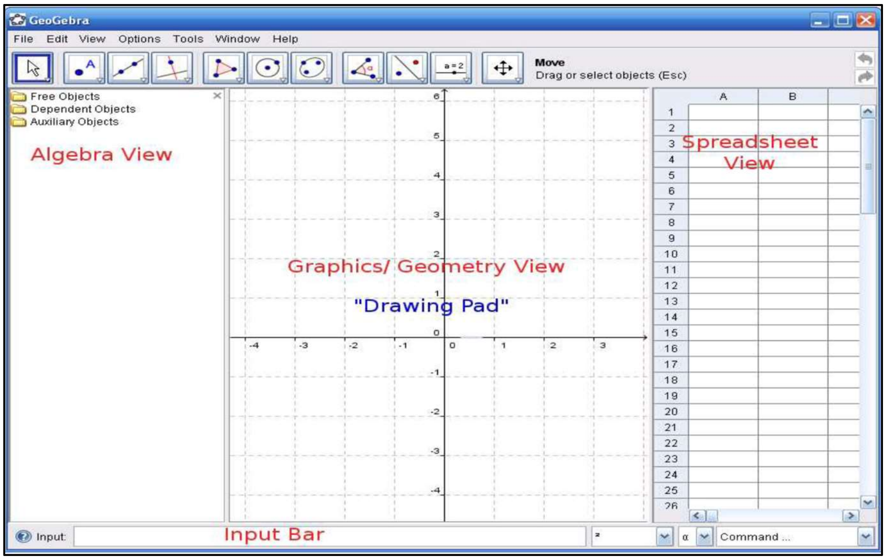

Figure 2: GeoGebra View with Grids

Also, the result on the attitude and behavioural intention revealed that students tend to focus on the ease of use and usefulness of GeoGebraof instructional package before showing their intention of the package. It could be observed that students are ready to integrate ICT in their education if they find that the ICT is beneficial for them and if it has the potential to enrich their mathematical knowledge and skills.Venkatesh and Davis(2000) found that perceived usefulness is a strong determinant of users' intention. Generally, the results show a high degree of consistency with the study of Salih(2004) who found that computer enriched environment and multi- media enhanced classroom setting are positively and strongly correlated with student attitudes towards computer and they can foster positively toward the use of computer in education. Similarly, Philip, Jackson, and Dave (2011) found that computer assisted instruction (CAI) promotes positive attitudes towards mathematics learning and teaching.

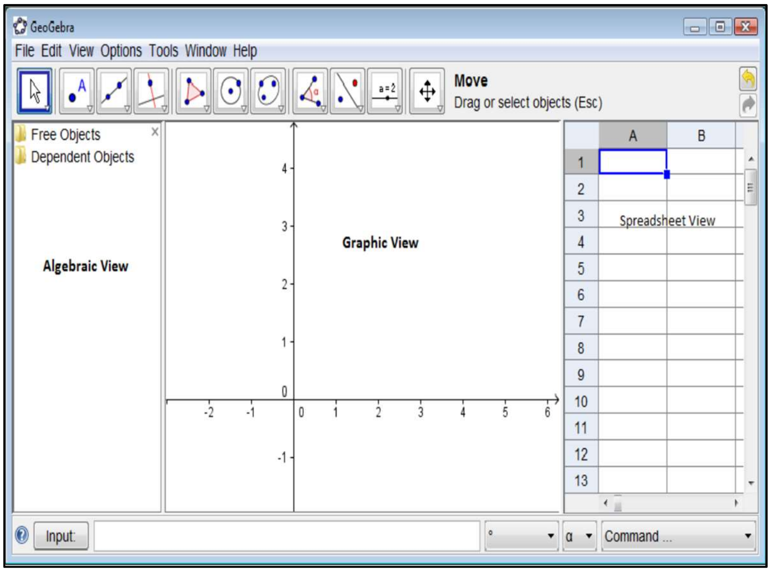

Figure 3: GeoGebra View without Grids

Finally, it was concluded that the attitude of students towards the use of Geolebrainstructional package depends on their perceptions on both its usefulness and ease of use. GeoGebra instructional package has proven as an effective tool for the studentsto learn linear equations.

Suggestions for Further Study

This study was limited to the perception of students towards the use of GeoGebra in learning mathematics. The sample is so small that could not be used to make generalized conclusion therefore, further study should be carried out on the effect of using GeoGebra on the performance of students in mathematics this could be extended to variables like gender, school locations, organization and school types.

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