FACTORS PREDICTING MATHEMATICS TEACHERS' USE OF LAPTOPS

Adedeji Tella
Teachers Education Department
Faculty of Education
University of Ibadan
E-mail: dejtell@yahoo.com
GSM: +(234)8037235517 and
+(234)08055676526

Abstract
ICT improves the way mathematics is being taught and enhances student understanding of basic concepts. Many researchers have carried out studies to evaluate the benefits of using ICT in mathematics. Laptop is one of the ICTs being used and adopted for the delivery of mathematics instructions. In Nigeria, the use of laptop for mathematics instructional delivery at the secondary school level has just begun to gain pace. In the light of this, it is considered necessary to examine factors predicting use and adoption of laptops by the secondary school mathematics teachers. In the light of this, this paper examines factors predicting mathematics teachers' use of laptop. The population of the study comprised 600 secondary school's mathematics teachers who were selected from secondary school across South West geo-political zone in Nigeria. A survey approach was adopted for the study and questionnaire was used for the collection of data on the study. The study reveals that, six factors except computer anxiety correlate with mathematics teachers' use of laptops. The six factors (ease of use, perceived usefulness, prior computer experience, teaching quality, and teaching effectiveness and Computer anxiety) together made 74% of mathematics teacher laptops use. The entire actors again exerted significant contribution to mathematics teachers' uses of laptops. In other words, the six laptops use prediction variables significantly explain use of laptops by the mathematics teachers. Since the study demonstrated that laptops is easier to use and its considered being useful and improve the quality of teaching and makes teaching effective; it is recommended that mathematics teachers who have

phobia for the use of laptops should do away with the phobia, and endeavour to familiarise themselves with the laptop so that they can as well make use of it to improve their teaching and instructional delivery of the subject.

Keywords: Information communication technologies, Laptops, Instructional delivery, mathematics, Secondary schools, Teachers, Nigeria.

Introduction

The ultimate goal in promoting the use of ICT in schools might be to increase the effectiveness of teaching and improve pupils' learning. There is a general voice of people that ICT can improve the quality of teaching and learning in schools and so help increase standards of students (Poudel, 2007). The revolution brought by information communication technology (ICT), has resulted into integration of technology into teacher education. Different approaches are being adopted by teachers. These approaches taken by teachers to bring technology into their teaching can be categorized according to the primary user or controller of the technology the teacher educator, the teacher, or the student (Garolfalo, et al., 2000). These authors pointed out that, the teacher educator is the primary user of the technology. For example, it was explained that some teacher educators use multi-media case studies of rich teaching episodes to help teachers analyze teaching and learning environments, and some use technology to present information or to demonstrate explorations. In another approach, the teacher is being prepared to be the primary user of technology. For example, they are prepared to use technology productivity tools for word processing, grade and record keeping, web page production, and presentations. Also, many teachers are using subject-specific software and websites to create presentations, lectures, lessons, and assessments. A third approach to incorporating technology in teacher education indentified by (Garofelo et al., 2000) is to prepare teachers to have their future students use technology to investigate concepts and solve meaningful problems in the content areas. In the area of mathematics teaching for example, teachers are learning how to guide their students to use technologies such as spreadsheets, graphing calculators, dynamic geometry programs, and

playable websites to explore mathematics concepts and use mathematics to solve problems in applied contexts. Garofelo et al., (2000) concluded that, these three approaches and uses of technology are connected with different purposes and all can lead to better teacher effectiveness and improved student learning.

At present the world has been advancing towards a high technological and industrial position and ICT has become a part of almost every industry. There is also a high demand of people to work in industries, financial sectors or any other field where use of computers and ICT is essential. Industries, companies and people want to do lots of work systematically within the limited time and by the limited manpower. This has become possible with the help of modern technology including computers and ICT. As the use of computer and other forms of ICT has been increasing day by day, it has become necessary to include ICT in school curriculum including mathematics. ICT improves the way mathematics should be taught and enhances students understanding of the basic concepts. Many researchers have carried out studies to evaluate the benefits of using ICT in mathematics teaching. Laptop is one of the ICTs being used and adopted for the delivery of mathematics instructions. In Nigeria, the use of laptops for mathematics instructional delivery at the secondary school level has just begun to gain pace. While several studies provided data on the impact of laptops on motivation, attitudes and beliefs, computer skills, and leadership, less was done to track teaching and learning that occurs with laptops.In the light of this, it is considered necessary to examine factors predicting use and adoption of laptops by the secondary school mathematics teachers in Nigeria. Against this backdrop, this paper examines factors predicting mathematics teachers' uses of laptop. It is expected that the study will serve as pioneer research on which other relevant researches in the Nigeria context will be anchored.

Literature Review

Information Communication Technologies and the Teaching of Mathematics

There are varieties of ICT equipments and materials which can be used in teaching mathematics. Teachers and students use different forms of ICT in different places such as classroom, home, library, internet cafe

and community. ICT has been helpful for teachers preparing and managing teaching and students better understanding of the mathematical ideas through audio visual activities and experimentation.

Many schools, nowadays, have access to ICT hardware, mathematical software and programmes in teaching mathematics. Hardware that are used in teaching mathematics are PCs, laptops, notebooks, palmtops, PDAs, mobile phones, graphing calculators, projectors, monitors, motion detectors, sensors, digital cameras, scanners, printers and so on. Similarly, different software such as dynamic geometry software, computer algebra systems, graph plotting software, data handling software; programmes such as glass, bearings, transform etc; programming languages such as logo, basic; spreadsheets, symbol manipulators and algebra, computer added learning packages etc. With the advent of new technology, some companies have been developing new instruments and software in order to use in teaching and learning. For example, in collaboration with Intel and the Mathematical Association, the Mathematical

Toolkit and Number line have been designed specifically to support the teaching and learning of mathematics. These instruments and software are revised or upgraded to form new look and more functional. Similarly, some software companies are also producing mathematical software such as algebrator, universal math solver, which solve the mathematical problems.

Many good resources for mathematics can be accessed using the internet. Such resources provide interactive online mathematics tutorial, integrated mathematics programmes and package and many more. These resources are very useful in teaching mathematics and helpful in learning mathematics (Neis, 2006).

Several school teachers have also been using overhead projectors, interactive whiteboards/smart boards, large monitors, projectors, scanners, digital cameras and different multi-media resources. These tools have the power of ICT to manipulate images and data to work with a whole class on developing mathematical concepts. Some of the ICT instruments are more used and more important in teaching and learning mathematics. According to the Becta review 2006, interactive white boards were used most frequently in lessons in secondary schools by mathematics teachers(BECTA, 2006 p. 43).

Use of Laptops and Mathematics

As reported by Rockman et al. (1997, 1998, 2000), laptop use not only reinforces the utilization of successful learning strategies but also enables students to transfer the knowledge across disciplines. This is believed to occur because laptop students are involved in: (1) highly engaged and focused activities (spending more time on their work and completing larger projects); (2) frequently apply active learning strategies; (3) interact with each other about their work; (4) problem solving through project-based activities, which usually involve more critical thinking; and (5) regularly find information, make sense of it, and communicate it. Research provides evidence that students who engage in collaborative work, participating in more project-based learning, have higher levels of motivation (Wigfieldet al., 1998; Guthrie & Wigfield, 2000). When students are motivated, they demonstrate improved achievement (White, 1989; Roth & Paris,1991; Roderick & Engel, 2001; Haydel & Roeser, 2002; Gulek, 2003), they produce longer and higher quality writing samples (Reeves, 2001; Goldberg, Russell & Cook, 2003), and they spend more time doing homework (Parschal, Weinstein & Walberg, 1984; Walberg, 1984,1994; Walberg & Haertel, 1997). Similarly, teachers using a constructivist approach feel more empowered and spend less time lecturing (von Glaserfeld, 1995,1995b), have fewer classroom management problems (Marzano et al.,2003), and have more engaged learners in their classrooms (von Glaserfeld, 1987; Jonassen, 1991; Fosnot, 1996; Marzano et al., 2003). As seen in the evaluations conducted by Rockman et al. (1997, 1998, 2000), many of these outcomes were observed when students were provided with their own laptop through the *Anytime Anywhere Learning Project.*

There have been several research works regarding ICT and school mathematics. Some research works have explored the role of ICT in teaching and learning mathematics. Kieren (1998) considers the impact of computers on the mathematics curriculum in two perspectives: i) the computers and other multimedia devices as the medium to deliver the curriculum to the students in evermore elaborate and spectacular ways and ii) such devices as tools to allow students to construct or build own mathematical ideas in enhanced ways. ICT tools offer dynamic environment for both the teachers and students in which they can explore, share and convey mathematical

ideas and conceptions with demonstrations and visualisation. Some researchers have found that use of ICT tools can help reduce teachers' workload. This can be another positive aspect of ICT to help teachers teach more effectively. A report by the Information Technology Advisory Panel (1986) hassays: an IT aided system can act as a 'teacher's assistant' and can take on the burden of straight forward clerical work and some of the more mechanical parts of teaching itself, leaving the teacher free to concentrate on the individual needs of the students and on the higher level aspects of managing the learning process(p.14). There are still many more. However, literature on the adoption and use of technology has revealed several factors users consider before use, adoption and acceptance of technology. These include attitude, users' friendliness, ease of use, computer self-efficacy, job relevance, prior computer experience, among others. This study identifies six generic and most relevant factors considered pertinent to the use of laptops by the mathematics teachers including: ***ease of use, perceived usefulness, prior computer experience, teaching quality, teaching effectiveness and Computer anxiety***. In the light of this, the main purpose is to examine how these factors predict use of laptops and which among them best predict mathematics teachers' use of laptops.

To achieve this, three research questions were developed. These are

(1) What is the correlation between the six generic factors of laptops use among the secondary school mathematics teachers?
(2) To what extent does each factor predict mathematics teachers' laptops use?
(3) What is the joint contribution of the six generic factors to the prediction of mathematics teachers' use of laptops?

Methodology

Quantitative method was used to gather numerical data from the respondents. In other words, the study adopts a survey research design. The essence of this is to be able to capture large sample to allow generalization of the findings to the larger population. Questionnaires were involved to gather information from mathematics teachers selected across secondary schools in the South West geo-

political zone in Nigeria. These comprises of states like Lagos, Ogun, Osun, Oyo, Ekiti, Ondo.

Population, sample determination and selection

To ensure adequate sample in this study, sample was determined using a purposive method. The sample was determined by taking census of mathematics teachers in all the participating schools. The target population of the study was the mathematics teachers in the public secondary schools throughout the state. The sample for the study was selected from these above-named secondary schools. A purposive sampling technique was used to select a total of 100 mathematics teachers from across secondary schools in the five States that made up the South West geo-political zone in Nigeria. This indicates that 600 mathematics teacher participated in the study. The sample includes only those teachers who own a laptop. Table 1 contain the summary of the demographic information of the study participants.

Instrument

A questionnaire was used to gather data from the respondents. The items in the questionnaire were adapted from various previous technology use and adoption studies. The questionnaire consisted of 30 items organized in five domains/constructs intended to capture separate dimensions of laptops use (see Appendix). The following domain constructs were included in the questionnaire: *Perceived Usefulness* - adapted from (Lund, 2001) usability with use questionnaire with r = 0.92 Cronbach alpha; *Perceived Ease of Use* - adapted from Doll and Torzadeh (1988) end user computer satisfaction questionnaire with r = 0.90 Cronbach alpha; *Perceived Teaching Quality* - adapted from (Tella, 2009; Tella and Mutula, 2010), Blackboard system evaluation scale with r = 0.89 through Cronbach alpha; *Prior Computer experience* (with r = 0.95 Cronbach alpha; and *Perceived teaching Effectiveness*- adapted from (Feldman, 1976) students' evaluation of teaching and learning, SETE with r = 0.91 Cronbach alpha and Computer anxiety (with r = 0.87 . The overall reliability co-efficient of the questionnaire returned r = 0.88. This is in line with the minimum standard of 0.80 suggested for basic research and 0.90 suggested for use in applied setting where important decisions were usually made with respect to specific test scores (Nunally, 1978). The Likert response

format was adopted for all the items in each of the domain. This ranged from strongly agree to strongly disagree.

Data Analysis

Data collected were analysed using descriptive statistics, inter-correlation matrix, ANOVA and multiple regression analyse

Results

The results obtained in the study are hereby presented as follows:

Table 1: Bio-Data Information (N = 600)

Gender	**Frequency**	**Percentages %**
Male	459	76.5
Female	141	23.5
Total	**600**	**100**
Teaching Experience		
0 – 5 years	308	51.3
6 – 10 years	169	28.2
11 – 15 years	100	16.7
20 years +	23	3.8
Total	**600**	**100.0**
Class Taught		
JSS Classes	199	33.2
SSS 1	178	29.7
SSS 2	134	22.3
SSS 3	89	14.8
Total	**600**	**100.0**
State		
Lagos	100	16.7
Ogun	100	16.7
Oyo	100	16.7
Osun	100	16.7
Ondo	100	16.7
Ekiti	100	16.7
Total	**600**	**100**

The results in the table 1 above reveal that more male (76.5%) than female (23.5%) participated in the study. This implies that there are more males teaching mathematics in secondary schools in the South West geo-political which is the locale of the study. The results in table 1 also indicate that 51.3% of the participants have between 0-5 years of teaching Mathematics to secondary school students. This is followed by 28.6% who have between 6-10 years of teaching Mathematics at the secondary school level. A total of 16.7% have teaching the subject for between 11-15 years back while 3.8% have been teaching the subject at the secondary school for the past 20 years and above. On the class and level being taught by the respondents, the results reveal that (33.2%) are teaching junior secondary school classless. Moreover, the results indicate that (29.7.8%) are teaching the senior secondary class 1, (22.3%) are teaching senior class 2 while (14.8%) are teaching senior class 3. Furthermore, the results reveal that there were (16.7%) respondents that were selected from each of the participating state.

Table 2: Descriptive Statistics and Intercorrelation Matrix among Factors (N = 600)

Factors	Mean	Std. Deviation	N	Use	E. of use	P. usefulness	Prior Com. Exp.	Teaching. Quality	Comp Anxiety	Teaching Effectiveness
Use	112.224	23.987	600	1.000						
Ease of use	12.124	2.874	600	.444	1.000					
Perceived usefulness	10.220	2.315	600	**.387**	**.388**	1.000				
Prior com exp	6. 211	2.694	600	.367	.336	.418	1.000			
Teaching qual	8.966	2.067	600	**.527**	**.306**	**.525**	.393	1.000		
Teaching effectiveness	8.451	2.472	600	**.501**	.331	.421	.342	**.485**	1.000	
Computer Anxiety	2.305	0.259	600	.002	.023	.032	.043	.022	. 044	1.000
Teaching Effectiveness	13.456	3.389	600	**.500**	.296	.343	.242	.393	.511	.531

Legend- ***Ease of use, perceived usefulness, prior computer experience, teaching quality, teaching effectiveness and Computer anxiety.***

Table 2 reveals that correlation exists between the overall Mathematics teachers' laptops use score and the other technology related factors. The results show that teaching quality had the highest correlation with math teachers' laptops use (r = .527). This is followed by teaching effectiveness (r = 0.50) and ease of use (r =0.44). Others followed in these order: perceived usefulness (r = 38), prior computer experience (r = .37). A correlation of other factors reveal computer anxiety has the lowest but negative correlation with (r =002). This suggests that all these factors except computer anxiety correlate with mathematics teachers' laptops user.

The next analysis focuses the technology related factors which cause changes on the dependent variable (use of laptops).

Table 3: Model Summary of Multiple Regression Analysis on the Effect of Laptops Use (Dependent Variable) by Six (Independent variables) (N = 600)

Multiple R	.734
R Square	.555
Adjusted R Square	.532
Std. Error of the Estimate	4.822
Log-likelihood Function Value	-1107.704

ANOVA

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Regression	33115.293	6	5519.215	2.30	0.05
Residual	1426.000	594	2400.673		
Total	34541.293	600			

Table 3 suggests that the R square = 0.555, R value adjusted =0.532, and the overall correlation between laptops use and use prediction factors yielded an R = 734, while the standard error of the estimate yielded 4.222. In the second step, the analysis of variance performed on simple regression yielded an F-ratio value of 2.30. This was found to be significant at 0.05 levels. These results suggest that the six independent variables (***ease of use, perceived usefulness, prior computer experience, teaching quality, teaching effectiveness and Computer anxiety)*** together made 74% of mathematics teacher laptops use. This suggests that the variables have direct prediction on the laptops use of the mathematics teachers In order to get the weight estimate on the contribution of each of the independent variable; the co-efficient of the variance was calculated. The results are presented in table 3.

Table 4: Coefficients (a) System Related Factors and User Satisfaction (N =600)

	Unstandardized Coefficients		**Standardized Coefficients**		**T**	**Sig.**
	B	**Std. Error**	**Beta**	**Std. Error**	**B**	**Std. Error**
(Constant)	-.446	.775			-.895	.301
EOU	.336	.043	.384	.038	3.455	.000
PU	.185	.063	.127	.040	2.943	.003
PCE	.185	.041	.116	.042	2.751	.006
T. Qual	.375	.076	.296	.041	5.662	.000
T. Effect.	.327	.054	.284	.040	6.118	.000
Com. Anx.	.099	.030	.070	.035	0.965	.050

The individual contribution of each of the factors to laptops use reveal in table 4above indicate that teaching effectiveness made the most significant contribution with (t = 6. 12; Beta Value .284), this is followed by teaching quality with (t = 5.66, with a Beta value of .296). The next factors that exert significant contribution to teachers' use of laptops is perceive ease of use (3.46; with a Beta value of .384); while perceived usefulness (t = 2.94; and Beta value of .127); followed. Others, prior computer experience (t = 2.75, Beta .116), and computer anxiety (t = 0.97, Beta .090) followed in that order. These results imply that all the

six factors exert significant contribution to mathematics teachers' laptops use. In other words, it is clear from the analysis above that the six laptops use prediction variables explain use of laptops by the mathematics teachers.

Conclusion

This study examined factors predicting mathematics teachers' use of laptops. The results have demonstrates that the six identified factors except computer anxiety correlate with mathematics teachers' use of laptops. The six independent variables (ease of use, perceived usefulness, prior computer experience, teaching quality, and teaching effectiveness and Computer anxiety)together made 74% of mathematics teacher laptops use. All the six factors exert significant contribution to mathematics teachers' uses of laptops. In other words, it is clear from the analysis that the six laptops use prediction variables significantly explain use of laptops by the mathematics teachers.

Recommendations

Based on the findings of this study, the following are recommended among others: that since laptops is easier to use and its considered being useful and improve the quality of teaching and makes teaching effective; mathematics teachers who have phobia for the use of laptops are called upon to do away with this, and endeavour to familiarise themselves with the laptop so that they can as well make use of it to improve their teaching and mathematics instructional delivery.

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