



EXAMINING THE INFLUENCE OF COMPUTER LITERACY AND MATHEMATICS COMPETENCY ON PRE-SERVICE TEACHERS IN NIGERIA

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ABSTRACT

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Since it has been well established that students' learning and achievements depend hugely on teachers' ability and competency, this study was aimed at investigating the issues of computer literacy and mathematics competency in human resource development among pre-service teachers. Two test instruments, the mathematics competency test (MCT) and the computer appreciation test (CAT) were used for data collection. The study was guided by two research questions and two corresponding null hypotheses tested at the 0.05 level of significance. The result obtained showed that mathematics competency and computer literacy had significant influence on pre-service teachers' performance. Those competent in Mathematics with understanding of computer applications performed better in both MCT and CAT. Gender was also found to be a big criterion in determining the differences in the mathematical and computer skills among pre-service teachers. From these findings, the study recommends that institutions involved in the 21st century teacher preparation programme should ensure that their products are potential teachers with high quality training, rooted in mathematics competency and computer literacy and in tandem with current global best practices.

Contribution/Originality: Since studies on the influence of mathematics and computer competency on students' achievement in Nigeria are scarce in literature, this study comprehensively examined the trends in preparing pre-service teachers in mathematics and also checked the extent to which they have acquired basic computer skills in relation to mathematics. Findings obtained will be useful to educational policy makers in Nigeria.

1. INTRODUCTION

Among all educational resources, human resource (teacher's ability and competency) is particularly crucial to students' learning and achievement (Asiyai, 2011; Darling-Hammond, 2006; Onocha, 2013). According to these researchers, availability of qualified and competent teachers at all levels and field of the educational system help to enhance quality output. The teacher's success in the classroom depends on the knowledge he or she has acquired, and his or her explicit understanding of the profession based on the new trends of globalization processes. It is the training a teacher has acquired that can provide him or her with the knowledge, skills and aptitude to be familiar with the art and science of teaching that is technology-based, without which the confidence to carry out his or her expected tasks will be lacking.

Educational practices globally have been transformed through technological development, specifically in the area of Information and Communication Technology (Iroriteraye-Adjekpovu, 2012). The world today has become a

global village through Information and Communication Technology (ICT), and the teacher who is one of the major educational resources is not left out in its acquisition. According to Iroriteraye-Adjekpovu (2012) unless teachers are trained with proper tools of the 21st century ICT, they cannot produce products that will serve the needs of the educated society.

Basic skills that employers and education providers look out for are fundamental skills in English language, Mathematics and computer literacy. These are functional skills required in carrying out tasks in our daily life activities and workplaces. Computer literacy encompasses two technologies: information technology (which is the use of computer and other related devices to capture, store, process data, produce information and save time) and communication technology, which is the use of devices such as mobile phones, broadcasting in radio and television through satellites (Iroriteraye-Adjekpovu, 2012). Chris Nico Association for Progressive Communication, as cited in Ubogu (2011) reported that if teachers are to be held accountable for identifying and teaching the basic functional skills or a process component in any field of endeavour, then they should be provided with the training necessary to execute such tasks (Brown, 1977).

The essence of teacher preparation is for the development of human resources that can expose them to necessary knowledge and skills in order for them to become stock of competencies; whereby they in turn, are to produce valuable candidates for employment and can play active and responsible roles in society. Researchers (Atakpo, 2012; Iroriteraye-Adjekpovu, 2012; Umaru, 2012) and many others have observed that training opportunities available to the teacher enable him or her build skills, confidence and teaching-learning strategies that integrate modern technologies to enhance students' achievement in most disciplines. Therefore, the key to human resource development in any society is the teacher, who in turn will provide the training that students need in acquiring predetermined desired skills, knowledge and attitudes needed for the effective running of society. Quality education helps students to better understand the world and hence plays a big role in human development.

Computer literacy is the ability of any individual to understand and use computer devices. It means being able to tell a computer to do what you want it to do. According to the ability to use the computer depends on the ability (of the user) to use the computer input devices, such as: the keyboard, mouse, and touch sensitive screen. Stating further, the researchers reported that, the input devices are the pen and pencil needed to write a test in computer-based testing. Although, studies have shown that, when students work with the computer, it results in increased learning, demonstrating greater retention and are better motivated to learn more (Okorodudu, 2012).

The teacher's response to the use of computers reflects his or her own literacy concerning the computer knowledge he or she is to facilitate. Literacy is an instrument for empowerment that individuals require to function effectively in society which has to do with the basic knowledge and skills that a person requires to contribute and belong to that society. Consequently, the teacher needs first and foremost, computer literacy training, which is the hallmark of teaching-learning process in this 21st century (Iroriteraye-Adjekpovu, 2012) in order to improve on his or her technology-based knowledge and skills. This is because, no educational system can rise above the quality of its teachers (Federal Republic of Nigeria, 2004). Therefore, the computer literacy tools can be used to produce competent teachers before they can be accountable for the teaching and learning of the basic functional skills so desired.

2. LITERATURE REVIEW

2.1. *The Place of Mathematics Competence and Computer Literacy in Students' Achievement*

In any nation's developmental efforts, Mathematics is one of the fundamental skills that students need to acquire during their study in school, especially at the basic level of education. Mathematics is the science of numbers, quantity, measurement and space that provides students with empirical data upon which they can base sound decision (Odili, 2006). The numbers and symbols are used for calculations. Odili (2006) asserts further that, the learning of the art of economical living is a byproduct of the learning of mathematics. He states further that

with the use of mathematics and computer, significant advancements are realized in science, technology and the arts. Also, Osafehinti as cited in Odili (2006) observes that studying mathematics is a basic preparation for adult life, and a gateway to a vast array of career choices for students. Odili (2006) then avers that:

Mathematics competence is essential for the preparation of an informed citizenry and for continuous production of highly skilled personnel required by industry, technology and science. The progress of any nation depends upon her scientific and technological advancement which can only be built on sound mathematical education capable of making the citizens effectively functional in the natural and applied sciences (p.2).

A competent mathematics teacher is one who has acquired mathematical knowledge and skills, and he is able to demonstrate same at optimum level of acquisition and functioning. It is then and only then, such a teacher can impart the same to his or her students. It follows therefore, that an incompetent mathematics teacher can hamper students' achievement in the subject.

Inconsistent results have been reported by studies about students' performances in Mathematics based on gender (Akabogu, 2006; Akintomide & Akintomide, 2011; Moemeka, 2007; Omoruan, 2008). Akabogu (2006) reported that there is no significant difference between male and female students' performances in mathematics. Other studies (Akabogu, 2006; Omoruan, 2008) revealed that, male students perform better than females in mathematics. Omoruan (2008) reported significant difference of $Z_r=1.19$ and $Z_r=1.00$ for males and females respectively. Achuonye and Ezekoka (2011) reported mean achievement scores of 10.6 (42%) and 8.0 (32%) for male and female students respectively. Also, Lynn as cited in Akabogu (2006) asserted that, males perform better than females academically (a function of the brain size). According to the researcher, males have larger brain size than females, as such, are expected to have higher average intelligence quotient (I.Q). Akubuiroh and Ugwu, both as cited in Omoruan (2008) observed that most female students experience slightly higher emotion than their male counterparts when testing is involved, particularly in Mathematics; which can lead to low performance.

In computer literacy, studies (Achuonye & Ezekoka, 2011; Fan, Li, & Niess, 1999; Madongonda & Chitando, 2013) reported inconsistent results on students' performance in computer-based testing, based on gender. The study of revealed that, students with higher computer literacy (with a mean of 199.58, and a standard deviation of 48.38) performed better than those with poor computer literacy (that had a mean of 131.74 with standard deviation of 44.68) on the computer-based tests (CBT); statistically significant at $F(2,1717) = 18.33, p < 0.05$. The study also reported no significant difference between male and female students on CBT (Mean scores for male and female students were 129.97 and 130.57 respectively, with standard deviation of 47.7 and 46.0 respectively; $t(1718) = -0.268, p > 0.05$). But, Fan et al. (1999) reported that, female students performed better than male students in computer science technology courses.

The study of Achuonye and Ezekoka (2011) identified students with technophobia (fear of technology) and computer anxiety among female students in Imo State University, Owerri, Nigeria. The study of Madongonda and Chitando (2013) identified the presence of technophobia among students in Bachelor of Arts in English and Communication Studies (BAECS) programme at Zimbabwe Open University. The study of Madongonda and Chitando (2013) found majority of female students confident in their ability to use computers. Reporting the performance rates of the female students in computer skills, the researchers reported 15% of them as excellent, 50% as very good, 31% as good and only 4% reported poor. The researchers' report further indicated female students' relatively high level of interest on computer literacy; and that 80% of them agreed that computers help them to learn more easily. This study was necessitated by the dwindling performance of graduates, particularly graduate teachers, prepared to give solid foundation to future leaders of a great and challenging tomorrow. Most trained teachers now neither speak correct English nor are able to effectively teach the subjects for which have they been prepared. The main objective of this study, therefore, is to investigate the trends in preparing pre-service teachers

in mathematics competency; and to find out the extent to which they have acquired basic computer skills in relation to mathematics.

2.2. Research Questions

The following research questions guided the study:

1. To what extent does computer literacy level influence pre-service teachers' performance on Mathematics Competency Test (MCT)?
2. To what extent does gender and test mode influence pre-service teachers' performance?

2.3 Hypotheses

Two corresponding hypotheses were formulated and tested at the 0.05 level of alpha.

1. *There is no significant difference in the performance of pre-service teachers on MCT based on computer literacy levels.*
2. *There is no significant difference between the performance of pre-service teachers based on gender and test mode.*

3. METHODOLOGY

The study adopted the ex post facto research design since the data on the variables of interest were already in place for collection. The stratified random sampling technique was used to draw a sample of 1400 participants: 700 male and 700 female pre-service teachers. Participants were drawn from five out of the thirteen National Teacher Institute (NTI) Centres and two out of the four Colleges of Education in Delta State, Nigeria. The five (5) NTI Centres include: Obinomba, Eku, Ozoro, Sapele and Effurun; while the two (2) Colleges of Education include: Federal College of Education (Technical), Asaba and College of Physical and Health Education, Mosogar.

Two instruments: a mathematics competency test (MCT) and a computer appreciation test (CAT) were developed and used for data collection. Tables of specification were drawn to give both test instruments high content validity (Fan et al., 1999). The face validity of the instruments were ascertained by two experts in computer knowledge and in measurement and evaluation. The reliability coefficients of internal consistency of both instruments (MCT = 0.81 and CAT = 0.78) were determined using the Kuder Richardson formula 21. Both instruments were used to ascertain participants' mathematics competency and computer understanding levels. Section A of both instruments consisted of students' personal data such as gender, institution and programme; while Section B consisted of the items participants responded to. The instruments were administered by the researcher with the assistance of some colleagues. Data generated with the instruments (MCT & CAT) were analyzed using descriptive statistics (mean & standard deviation) for the research questions and one-way and two-way analysis of variance for the two null hypotheses.

3. RESULTS AND FINDINGS

Research Question 1: To what extent does computer literacy level influence pre-service teachers' performance on MCT? The results of research question 1 are shown in Table 1.

Table-1. Descriptive statistics (mean and standard deviation) of students' performance on MCT based on computer literacy.

Computer literary levels	N	Mean	MCT SD
High	287	178.18	38.49
Average	515	152.00	31.63
Poor	598	117.11	28.05
Total	1400		

Table 1 shows the mean and standard deviation of pre-service teachers' performance on MCT based on their computer literacy levels. Those with high computer literacy level had a mean of 178.18 with a standard deviation of 38.49; while those with poor computer literacy level had a mean of 117.11 with a standard deviation of 28.05.

Research Question 2: To what extent does gender and test mode influence pre-service teachers' performance?

The results of research question 2 are shown in Table 2.

Table-2. Descriptive statistics (mean and standard deviation) of the performance of pre-service teachers based on gender and test mode.

Gender	Mode	N	Mean	SD
Male	MCT	700	205.75	14.43
	CAT	700	109.05	37.57
	Total	1400	131.78	29.73
Female	MCT	700	198.29	17.71
	CAT	700	122.35	36.23
	Total	700	112.71	27.09

Table 2 shows the mean scores of male and female pre-service teachers for MCT and CAT as 131.78 and 112.71 with standard deviations of 29.73 and 27.09, respectively.

Null Hypothesis (Ho₁): There is no significant difference in the performance of preservice teachers on MCT based on computer literacy levels.

The result of hypothesis one is shown in Table 3.

Table-3. One-way analysis of variance (ANOVA) of students' performance on MCT based on computer literacy levels.

Source of variation	SS	DF	MS	F	Sig
Between Group	71107.4	2	27213.4	16.03	.001
Within Group	2791571	1398	20.3		
Total	2502678.4	1400			

Table 3 shows $F = 16.03$ and p -value of .001. The p -value is less than the chosen alpha level of 0.05. This means that the difference is statistically significant. Therefore, the null hypothesis which states "there is no significant difference in the performance of pre-service teachers on MCT based on computer literacy levels" is rejected; $F(2, 1398) = 16.03, p < 0.05$. This indicates that there is a significant difference.

Null Hypothesis (Ho₂): There is no significant difference between the performance of pre-service teachers based on gender and test mode. Table 4 shows a p -value of .001 for gender which is less than the chosen alpha of 0.05; which means that gender has significant effect on performance.

Table-4. Two-way ANOVA of the performance of pre-service teachers based on gender and test mode.

Source	Type III SS	DF	MS	F	Sig
Corrected model	7023515.61	4	1272108.135	1713.505	.000
Intercept	110249471.02	1	101364386.712	65576.128	.000
Gender	1711.129	1	21172.126	18.346	.001
Mode	7122501.193	1	5928011.100	3553.701	.001
Gender mode	2310.255	1	1819.177	11.133	.002
Error	4117285.311	2796	1001.812		
Total	121493278.908	2800			
Corrected total	11243807.88	2799			

The interaction of gender and test mode has a p -value of 0.002, which is also less than the chosen alpha (.05). Therefore, the null hypothesis which states that "there is no significant difference between the performance of pre-service teachers based on gender and test mode" is rejected. The results indicate that, there is a significant difference in the performance of pre-service teachers based on gender and test mode.

4. DISCUSSION

The results in Tables 1 and 3 revealing the performances of pre-service teachers on MCT based on computer literacy levels, supports the study of Umaru (2012) and Atakpo (2012). These researchers asserted that computer literacy has high positive effect on the performance of students; and hence, the pre-service teachers can only impact this knowledge on their students after graduation only when they, themselves are able to demonstrate the same at the optimum level of acquisition. From Table 1, only 287 out of the 1400 participants were able to fall under those with high computer literacy level; 515 on the average level and 598 on poor level. This result is not encouraging for a developing country like Nigeria that needs more scientists and technologists for her development.

The results from Tables 2 and 4 revealed that mathematics competency and computer literacy have a significant combined influence on pre-service teachers' performance. The results also revealed a significant difference among male and female pre-service teachers' performance on MCT based on their computer literacy levels and mode of testing. More males have higher means (205.72 and 109.05) on MCT and CAT respectively than the females (198.29 and 122.35) on MCT and CAT, respectively. All these findings support the study of Omoruan (2008) that male students perform better in mathematics than female students. Also, these findings support the study of Achuonye and Ezekoka (2011) which identified female students with technophobia and computer anxiety among students in Imo State University, Owerri, Nigeria. Students having technophobia and computer anxiety will perform poorly in any computer-based test. A computer-based test requires some level of competency in the use of computers.

Table 4 revealed that the computer literacy has a test mode effect of $F = 3553.701$ significant at .001. This is less than chosen alpha ($p < 0.05$) and means that some pre-service teachers did well at MCT than on CAT. This can be attributed to a sign of technophobia or computer anxiety as identified by Madongonda and Chitando (2013) and Achuonye and Ezekoka (2011). Though gender was found to be a huge determining factor of mathematics competency and computer literacy among the pre-service teachers, results obtained as shown in Tables 3 and 4 did not support the report of Fan et al. (1999) that female students performed better than male students in Computer Science technology courses.

5. CONCLUSION

The findings of this study indicated that majority of pre-service teachers in Nigeria are neither competent in mathematics nor computer literate. Gender was also found to be a major determining factor of mathematics competency and computer literacy among the pre-service teachers. The study also revealed that computer literacy promotes development of mathematics problem-solving skills; and can generate positive attitude towards mathematics.

6. RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

1. Institutions and policies involved in the 21st century teacher preparation should ensure that the high quality training of pre-service teachers is in line with the new global computer literacy trends.
2. The teacher programme must be planned to enable the pre-service teachers gain the greatest learning experiences by blending mathematical skills acquisition with the use of computers.
3. Learning opportunities via computer-assisted learning (CAL) should be made available for the training of the pre-service teachers.

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