Attitudes toward Computer, Computer Anxiety and Gender as determinants of Pre-service Science, Technology, and Mathematics Teachers' Computer Self-efficacy

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Abstract

For Nigeria to attain her Vision 20: 2020, the school curricula must change in line with the development in technology. Teachers should be able to adapt technology into the teaching and learning process. Three non-intellectual elements that affect the degree of integration of technology into teaching and learning are attitude toward computer, computer anxiety and computer self-efficacy. The study investigated attitudes towards computer, computer anxiety and gender as determinants of computer self-efficacy among 2100 pre-service science, technology and mathematics (STM) teachers from the University of Lagos of Nigeria using the quantitative research method within the blueprint of the descriptive survey design. Data collected were analysed using the descriptive statistics of percentages, mean, and standard deviation and inferential statistics of independent samples t-test, Pearson product-moment correlation coefficient and multiple regression analysis. Finding revealed significant correlations between computer attitudes, computer anxiety and computer self-efficacy. Gender differences in attitude toward computer, computer self-efficacy and computer anxiety among pre-service STM teachers were significant. Affective component; perceived control component; perceived usefulness component; behavioural intention component; gender; and computer anxiety made statistically significant contributions to the variance in pre-service STM teachers' computer self-efficacy. The study recommended among others that academic institutions should pay more attention to this computer anxiety and adopt proper ways of reducing the computer anxiety. This will enable positive e-learning experiences to be created for pre-service STM teachers.

Keywords

Computer attitude; computer self-efficacy; computer anxiety; pre-service STM teacher

I. Introduction

Computers are progressively more pervasive, affecting various facets of our societal and work lives, as well as several of our time-out undertakings. As more jobs consist of human-computer interaction, computer skills and knowledge have become more clearly associated with both work-related and individual attainment. The teaching and learning process has been transformed by the coming together of a range of high-tech, instructional, and didactic developments in modern periods (Aktağ, 2015; Huang & Kinshuk, 2013; Sam, Othman & Nordin, 2005). Technology is provoking the frontiers of the pedagogical configurations that have conventionally eased learning. Modern improvements in computer technology and the flow of personal computers, productivity software, multimedia, and network resources in this twenty-first century, signalled the expansion and execution of novel and state-of-the-art instructional strategies. Educators who support technology incorporation in the teaching and learning process are of the view that it will advance teaching and learning and better organize students to excellently partake in the 21st-century workplace (Sultan & Kanwal, 2017; Hopson, Simms, & Knezek, 2002). Consequently, as we progress into such a technology-driven world, it is imperative that teaching space involvements with computers are made accessible to all students. Nevertheless, the use of the computer in the teaching space often remains marginal and negligible (Achima & Al Kassimb, 2015; Lim & Khine 2006), knowing full well that the teacher is strategic to actual use of computers in the educational system (Zhao, Hueyshan & Mishra, 2011). It is vital to comprehend teachers' attitudes toward computer and the elements that affect these attitudes. The fruitful integration of computers in the teaching and learning process is a function of the attitudes of teachers and their readiness to accept the technology. Investigating the attitudes of teachers toward computers could provide answer to questions relating to reception and adoption of technology in the teaching and learning process.

The triumph of any ingenuities to apply technology in an educational programme depends largely and strongly upon the backing and attitudes of teachers involved. This is because if teachers perceived the proposed computer programmes as achieving neither their own nor their students' desires, they are less likely to try to integrate technology into their teaching and learning process. One major factor that affects the successful use of computers in the teaching space is the teacher attitude toward computer (Wambiri & Ndani, 2016; Awofala, Akinoso & Fatade, 2017; Huang & Liaw, 2005) and it is a significant predictor of future computer use in the classroom (Mingaine, 2013; Myers & Halpin, 2002) in which the amount of computer experience has a positive effect on attitude towards computers (Kumar & Kumar, 2003; Abidin, Pour-Mohammadi, Shoar, See, & Jafre, 2011).

Self-efficacy is another predictor element of future computer use (Awofala, Akinoso & Fatade, 2017; Alahakoon, 2016) and internet usage (Oyewusi, Sokoya, & Aramide, 2016) is grounded in the theoretical framework of social cognitive theory which emphasises the evolvement and exercise of human agency that people can exercise some influence over what they do (Bandura, 2006). Self-efficacy according to Bandura (2006) is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Computer self-efficacy is the beliefs of people about their competences to produce designated levels of performance on computer (Awofala, Akinoso & Fatade, 2017). It is evidently clear that self-efficacy beliefs moderate an individual technology use (Awofala, Akinoso & Fatade, 2017) in which those individuals with higher self-efficacy beliefs made use of computers more often and experienced less computer-induced anxiety than those with lower self-efficacy beliefs (Aktağ, & Tuzcuoğlu, 2016; Compeau & Higgins, 1995). More so, those individuals with lower computer self-efficacy beliefs incline to become more frustrated and anxious when working with computers and hesitate to use computers when they bump into obstacles (Aktağ, & Tuzcuoğlu, 2016; Compeau & Higgins, 1995). Computer

self-efficacy has a significantly positive influence on an individual's expectations towards using computers (Aktağ, & Tuzcuoğlu, 2016; Teo, 2008) and individuals who saw themselves as incapable to use the computer tend not to use computers (Oliver & Shapiro 1993). It is obvious that computer self-efficacy increases performance and reduces computer induced anxiety (Balogun & Olanrewaju, 2016; Harrison & Rainer 2003) among users and that teachers' computer self-efficacy is a strong influence moulding their patterns of computer use (Achima & Al Kassimb, 2015; Albion, 2001). More so, computer self-efficacy meaningfully predicted pre-service teachers' ability to incorporate technology use in the classroom (Okhakhume & Ogunlude, 2016; Litterell, Zagumny, & Zagumny, 2005; Zhao, Pugh, Sheldon, & Byers, 2002).

Computer anxiety also plays a significant role in the education usage of computer. Computer anxiety is the feeling of uncomfortable when using a computer (Awofala, Akinoso & Fatade, 2017). The anxious person may have some negative thoughts, sweaty hand and increased heart rate or want to avoid working with a computer. Anxiety typically arises when something new is being learned and this brings about resistance to change which may have a negative influence on cognitive performance. Computer anxiety has been conceptualized as a multi-dimensional construct (Simsek, 2011) in which three major dimensions have been identified (Torkzadeh & Angulo, 1992) as psychological, operational, and sociological. Psychological dimension includes attitudes toward computers, self-efficacy, personality types, avoidance, and self-perceptions. Operational dimension usually results from computer courses, teachers, nature of computers, the extent of experiences with the computer, and owning a personal computer. Sociological dimension is related to factors of age, gender, nationality, socio-economic status, and the field of study. Research has found that computer anxiety has a strong negative influence on computer-related activities such as computing skills, intention to use computers, attitudes toward computer, and perceived usefulness of computers (Fatemi Jahromi, Forouzan, & Gholaminejad, 2017; Aktağ 2015; Kingsley, 2005; Rahimi & Yadollahi, 2011; Venkatesh, Morris, & Ackerman, 2000; Teo, 2008). These findings showed that computer anxiety escalates struggle with computer and indicates a hurdle to a person's connection with computers (Arigbabu, 2009). Students who think positively about computer will notice errors when made as a difficulty to be arrested, relish learning new tricks and possess positive disposition towards computer. It is noted that lack of knowledge and skills in computer may have a strong negative effect on students' learning in the university. Therefore, educators must find a lasting solution to pre-service STM teachers' computer anxiety so as not to transfer the negative tendency to their students on getting to the field. Arresting the problem of computer anxiety which is a temporary condition through a comfortable learning environment will help pre-service STM teachers learn computer skills and use computers effortlessly irrespective gender.

The genderisation of computing is often a focus of research in many countries of the world (Durndell & Haag, 2002) including the USA (Farenga & Joyce, 1999) and the UK (Roger & Duffield, 2000) as gender plays a crucial role in pre-service STM teachers' attitude, self-efficacy and anxiety towards computer usage (Awofala, Akinoso & Fatade, 2017). It has been established that there was no significant difference in attitudes toward computer-based on gender, but female participants were more positively disposed to using the internet than males (Birisci, Metin & Karakas, 2009). Relatedly, in a sample of Singaporean pre-service teachers, Teo (2008) found that there was no significant effect of gender on pre-service teachers' computer attitude. Contrastingly, females are more anxious or less experienced, and less confident in ICT competence than their male counterparts (Rekabdarkolaei & Amuei, 2008; Sultan, & Kanwal, 2017). More so, Jackson, Ervin, Gardner & Schmitt (2001) found that female users, compared with males, incline to exhibit negative reactions to computer technologies and such disparities may have contributed to the different ways of using computer technologies. Females often displayed more negative attitudes towards computers (Schumacher & Moharan-Martin, 2001)

and showed higher computer anxiety (McIlroy, Bunting, Tierney & Gordon, 2001; Sultan, & Kanwal, 2017) than their male counterparts. Research on computer self-efficacy in general showed that males on average tend to be more efficacious in the use of computer that is males possessed higher computer self-efficacy than females (Awofala, Fatade & Udeani, 2015; Todman, 2000; Sultan, & Kanwal, 2017; Öztürk, Bozkurt, Kartal, Demir, & Ekici, 2011). Contrastingly it has been found that female teachers displayed significantly higher computer self-efficacy than male teachers in Nigeria (Aremu & Fasan, 2012).

Globally there has been an appeal for a re-orientation of teaching and learning in schools towards the adoption of ICT facilities. The success of this appeal is a function of the willingness, attitude and level of knowledge of ICT controlled by teachers and its actual adoption in classroom instruction. In this information age, teacher education in Nigeria is bedeviled with a lot of challenges whereby using ICT facilities is a problem as many teachers are not ICT compliant and those under training in Colleges of Education, Institutes of Education, and Faculties of Education are not fully taught how to integrate ICT in the acquisition of skills and practical teaching in the classroom. It is shameful to observe that less than 10% of the teachers in Nigerian primary and secondary schools are computer literate (Owolabi, Oyewole & Oke, 2013) as many teachers in Nigeria are not using ICT facilities in teaching and learning due to high cost of ICT facilities, lack of infrastructures in the areas of electricity supply, and lack of adequate trained manpower for the development, maintenance and operation of ICT facilities (Haruna, 2005; Owolabi et al, 2013). Other challenges as noted by Haruna (2005) include lack of commitment on the part of government towards the development of ICT, inadequate funding of internet connectivity and lukewarm attitude of many teachers to be computer literate. These challenges militating against the effective use of ICT in teaching profession in Nigeria as most teachers who are expected to bring reform into Nigerian education system passed through the traditional 'old' system without any exposure to ICT (Ojo, 2005). Turning these teachers into digital immigrants becomes a problem in their attempt to acquire adequate mastery of skills and content that are embedded in ICT.

In attaining quality in schools, it is imperative to make sure that teachers are competent in incorporating technology into the school curriculum. But the foundation must be set at the pre-service teacher's level. Not to do this is an invitation to graduating future teachers with immature skills in the use of computer technology. In this 21st century, it is incumbent on teacher educators to provide pre-service STM teachers with the tools and experiences that will be required of them in their future job of classroom teaching, research, and problem-solving (Teo, 2008) and these call for the integration of technology into the classroom practices. Integrating technology into teaching and learning will not only enable pre-service STM teachers to arrange their environment and adjust their instructional strategies (John, 2013; Zhang & Espinosa, 1997) but provide them with opportunities to use technologies in teaching on the field. Teacher educators need to be conversant with pre-service STM teachers' attitudes towards computers, know how to reduce computer anxiety in them, and promote their computer self-efficacy as means of promoting teacher training curriculum that will prepare STM teachers ahead of the challenges in this 21st-century information age.

It is noted that about one-third of the college students in the developing countries including Nigeria suffer from technophobia (Teo, 2007; Arigbabu, 2009) and this meant that the adoption of computers in higher education might not be accomplished. In Nigeria, majority of the pre-service STM teachers seem not to possess the required confidence for the usage of ICT facilities for teaching and learning despite being digital natives. The implication of this is that the majority of the pre-service STM teachers were not grounded in the usage of computer for teaching and this will have negative influence on their attitudes and self-efficacy towards usage of computer technologies. More so, this may indirectly accentuate their fear and anxiety toward the usage of computer. It is against this

backdrop that this study seeks to investigate the attitudes towards computer, computer anxiety, and gender as determinants of pre-service STM teachers' computer self-efficacy. This study became necessary as there is a lack of studies to prove the relationship of computer attitudes and computer anxiety to computer self-efficacy among pre-service STM teachers in Nigeria (Awofala, Akinoso & Fatade, 2017). Thus, more research needs to be conducted in this area in Nigeria.

The main purpose of this study is to investigate the attitudes towards computer, computer anxiety, and gender as determinants of pre-service STM teachers' computer self-efficacy. Specifically, the following research questions were raised to guide the study

1. What is the relationship among attitudes towards computer, computer anxiety, gender and computer self-efficacy of pre-service STM teachers?
2. What is the influence of gender on pre-service STM teachers' attitude towards computer, computer anxiety and computer self-efficacy?
3. What is the joint contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer anxiety and gender to the explanation of the variance in pre-service STM teachers' computer self-efficacy?
4. What is the relative contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer anxiety and gender to the explanation of the variance in pre-service STM teachers' computer self-efficacy?

II. Method

a. Research Design

The model of investigation utilized in the present study was a quantitative research method (Awofala & Anyikwa, 2014) defined as a methodical pragmatic inquiry of societal occurrences through numerical, scientific or computational procedures within the scheme of descriptive survey design (Awofala, Akinoso & Fatade, 2017). The descriptive survey design was adopted in this study partly because it helps to assess thoughts, opinions, and feelings regarding attitudes toward computer, computer self-efficacy, and computer anxiety (Awofala, Akinoso & Fatade, 2017) and partly because it allows identification of variables in the study. The descriptive survey independent variables were attitudes toward computer, computer anxiety and gender while the dependent variable was computer self-efficacy and finding solutions to the research questions for the study needed data that allowed assessment of computer attitude, computer anxiety and gender as predictors of pre-service STM teachers' computer self-efficacy. This study depended on interval data (scores on Attitudes toward Computer Scale, Computer Anxiety Rating Scale, and Computer Self-efficacy Scale) as a robust form of quantification.

b. Participants

The population of this study comprised pre-service science, technology and mathematics (STM) teachers at the Department of Science and Technology Education, University of Lagos in Nigeria. Table 1 showed the sample of the participants involved in the study. It also showed the gender composition, the course of study, the age distribution and the grade level of the sample. There are six programmes of study in the Department of Science and Technology Education, University of Lagos, Nigeria. All participants were volunteers and no course credits were given for their participation. The sample was homogeneous—participants were primarily Nigerians, and all were English speaking. Moreover, all had

taken an introductory computer science course in their 100 level or as general course in their 200 level for direct entry students. All participants reported ready access to computers at the University.

Grade Level	**f (%)**	**male (%)**	**female (%)**
First year	644 (30.67)	318 (49.38)	326 (50.62)
$Mean_{age}$=19.4 years	SD_{age}=2.4 years	Age range=16-25 years	
Second year	505 (24.05)	249 (49.31)	256 (50.69)
$Mean_{age}$=22.4 years	SD_{age}=2.3 years	Age range=17-30 years	
Third year	485 (23.10)	238 (49.07)	247 (50.93)
$Mean_{age}$=21.4 years	SD_{age}=2.2 years	Age range=18-32 years	
Fourth year	466 (22.19)	230 (49.36)	236 (50.64)
$Mean_{age}$=23.8 years	SD_{age}=2.6 years	Age range=19-34 years	
Age distribution	**f (%)**		
Below 20 years	950 (45.23)		
20-34 years	1150 (54.76)		
Course of study	**f (%)**		
B.Sc(Ed) Biology	580 (27.62)		
B.Sc(Ed) Mathematics	440 (20.95)		
B.Sc(Ed) Physics	200 (9.52)		
B.Sc(Ed) Technology	280 (13.33)		
B.Sc(Ed) Home Economics	300 (14.29)		
B.Sc(Ed) Chemistry	300 (14.29)		
	f (%)		
Total Sample	2100		
Male	1035 (49.29)		
Female	1065 (50.71)		

Table 1. Participants' demographic data.

c. Research Instruments

For the purpose of data collection, three instruments tagged Attitudes towards Computer Scale (ATCS) adopted from Selwyn (1997), Computer Anxiety Rating Scale (CARS) adopted from (Embi, 2007) and Computer Self-Efficacy Scale (CSES) adopted from (Durndell & Haag, 2002) were used to collect primary data relating to attitude toward computer, computer anxiety, and computer self-efficacy respectively. These three instruments are related in that they are questionnaires, which are considered useful and suitable for this study because of their ''versatility, efficiency and generalisability'' (McMillan, 2004). One limitation of questionnaires is that they do not allow the researchers to further their enquiry as would be likely in an interview (Mertler & Charles, 2005). The ATCS consisted of 21 items anchored on a 4-point scale ranging from: Strongly agree -4, Agree -3, Disagree -2, to Strongly disagree -1. The scores could range from between 21 and 84. In this study, the negative items were reversed coded so that meaningful analyses at the sub-scale level could be conducted. The ATCS consists of four components of computer attitudes namely: Affect (six items) and measures feelings towards computers; Perceived Usefulness (five items) and measures the individual's beliefs about the usefulness of computers in their job; Perceived Control (six items) and measures the perceived comfort level or difficulty of using computers; and Behavioural Intention (four items) and measures behavioural intentions and actions with respect to computers. The CARS consisted of 18 items in which 8 items were positively worded and the remaining 10 items negatively worded anchored on a 4-point scale ranging from: Strongly agree -4, Agree -3, Disagree -2, to Strongly disagree -1. The scores could range from between 18 and 72. The CSES consisted of 29 items on a 4-point type format: ranging from: Strongly agree -4, Agree -3, Disagree -2, to Strongly disagree -1. All items on the CSES were positively worded statements that reflected a variety of

computer-related skills. High scores indicated a high degree of confidence in one's ability to use computers and scores could range from between 29 and 116.
The three instruments (ATCS, CARS, and CSES) were subjected to face validity by two experts in measurement and evaluation at the University of Lagos for appropriateness for the study to fine-tune and scrutinize the research instruments despite being standardized instruments. The ATCS is a reliable instrument to measure attitude towards computer among teacher education students. Using the ATCS on 310 undergraduate students in mathematics education, Awofala, Akinoso and Fatade (2017) reported that the ATCS possessed high reliability (α = 0.84). The internal consistency reliabilities for the subscales are: affective component (α = 0.87), perceived usefulness component (α = 0.78), perceived control component (α = 0.91) and behavioural intention component (α = 0.82) and these were considered very high and theoretically significant (Awofala & Anyikwa, 2014).

Using the CARS on 14 faculty members, Embi (2007) reported that CARS possessed high reliability (alpha=0.74). According to Durndell and Haag (2002), the internal consistency reliability coefficients of the CSES was computed using the Cronbach alpha (α) with a value of 0.96. Awofala, Fatade and Udeani (2015) had validated the CSES for Nigerian use with a sample of 480 pre-service science, technology and mathematics teachers and found that computer self-efficacy is a multi-dimensional construct consisting of beginning skill, advanced skill, and file and software skill using exploratory factor analysis and a high internal consistency reliability coefficient of 0.87 computed using Cronbach alpha. The internal consistency reliabilities for the subscales of computer self-efficacy according to Awofala et al (2015) were: beginning skill (α = 0.81), advanced skill (α = 0.83), and file and software skill (α = 0.74). In the present study, the three instruments were pilot tested on a sample of 200 pre-service teachers not part of the study sample and internal consistency reliabilities of the three instruments were computed using the Cronbach alpha (α) with values of 0.92, 0.88, and 0.94 for ATCS, CARS and CSES respectively. These values point to the fact that the three instruments were highly reliable and could be used for the study. The three research instruments (ATCS, CARS & CSES) used in the present study were deliberated as acceptable and suitable as established in piloting results, which revealed no vagueness.

d. Procedure for Data Collection

Data were collected from the participants in the Department of Science and Technology Education, Faculty of Education, University of Lagos voluntarily during the second semester of the 2016/2017 academic session. At all occasions, the researchers together with 12 research assistants administered the ATCS, CAS, and CSES to the whole sample and in a regularly scheduled class and the authors were present throughout the data collection process. After a brief introduction to the research, the survey questionnaires were distributed to students. On the average, students took about 50 minutes to complete the survey forms. There were also no questions from the participants as they were told that they could withdraw their participation during or after the data collection process.

e. Data Analysis

The quantitative data collected using ATCS, CARS & CSES were summarized and analysed using the means and standard deviations, which are essential antecedent to carrying out inferential statistical analysis of the independent samples t-test. This study tested differences in pre-service STM teachers' attitudes towards computer, computer anxiety and computer self-efficacy based on gender. This study used the t-test statistic partly because two groups (male and female) were involved and very significantly, the statistic is strong for making a comparison between two group means. Pearson's product-moment correlation was used to test relationships among the variables of the study, while multiple regression analysis was deployed to test for the joint and relative contributions of attitudes

toward computer, computer anxiety and gender to the explanation of variance in pre-service STM teachers' computer self-efficacy at 0.05 level of significance.

III. Results

Research Question One: What is the relationship among attitudes towards computer, computer anxiety, gender and computer self-efficacy of pre-service STM teachers?

	Variables							
	1	2	3	4	5	6	7	8
1. AFC	1.00							
2. PUC	.129**	1						
3. BIC	.475**	.018	1					
4. PCC	.435**	.172**	-.144**	1				
5. CA	-.042	-.213**	-.178**	-.059	1			
6. CSE	.334**	.116**	.383**	.035	-.140**	1		
7. ATC	.627**	.424**	.764**	.114**	-.138**	-.437**	1	
8. GENDER	.149**	-.006	.147**	.078	.043	-.214**	.193**	1
Mean	10.51	12.94	11.02	12.69	28.89	33.21	47.16	1.49
Standard deviation	2.70	1.94	2.40	1.70	3.80	2.49	4.54	.50

Table 2. Mean, standard deviation, and intercorrelations among attitudes towards computer, computer self-efficacy, gender and computer anxiety of pre-service STM teachers for total sample (n=2100)

**Correlation is significant at the 0.01 level (2-tailed) *Correlation is significant at the 0.05 level (2-tailed). AFC=affective component; PUC=perceived usefulness component; BIC=behavioural intention component; PCC=perceived control component; CA=computer anxiety; CSE=computer self-efficacy, ATC=attitudes toward computer.

Table 2 showed the relationships among attitudes toward computer and its subscale, computer anxiety and computer self- efficacy of the pre-service STM teachers. The result of Pearson Product Moment Correlation coefficient showed that there were significant negative correlations among the dimensions of attitudes toward computer and computer anxiety. Computer anxiety was negatively correlated with computer self-efficacy. Computer self-efficacy was positively correlated with affective component, perceived usefulness and behavioural intention component. Gender was positively correlated with affective component and behavioural intention component but negatively correlated with self-efficacy.

Research Question Two: What is the influence of gender on pre-service STM teachers' attitude towards computer, computer anxiety and computer self-efficacy?
Independent samples t-test was used to answer this research question, the result of the analysis is presented in Table 3.

	Gender	N	M	SD	Df	t	p	ES (Cohens'd)
AFC	Male	1035	10.92	2.54	2098	-6.89*	.000	.304
	Female	1065	10.11	2.78				
PUC	Male	1035	12.93	2.12	2098	0.27	.789	.010
	Female	1065	12.95	1.74				

BIC	Male	1035	11.37	2.07	2098	-6.83*	.000	.296
	Female	1065	10.67	2.63				
PCC	Male	1035	12.83	1.61	2098	-3.56*	.000	.160
	Female	1065	12.56	1.77				
CA	Male	1035	29.05	3.50	2098	-1.97*	.049	.087
	Female	1065	28.72	4.06				
CSE	Male	1035	32.67	2.50	2098	10.05*	.000	.436
	Female	1065	33.73	2.36				
ATC	Male	1035	48.04	4.57	2098	-9.00*	.000	.393
	Female	1065	46.29	4.33				

Table 3. Independent samples t-test analysis of pre-service STM teachers' attitudes towards computer, computer anxiety and computer self-efficacy according to gender.

*Significance at p<.05; ATC=attitudes toward computer.

Table 3 showed the descriptive statistics of mean and standard deviation and t-test values on attitudes towards computer, computer anxiety and computer self-efficacy scores by male and female pre-service STM teachers. Concerning the aggregate attitudes towards computer score, the female group recorded a lower mean score (M=46.29, SD= 4.33) than their male counterparts (M=48.04, SD=4.57). This difference in mean score was statistically significant (t2098= -9.00, p<.001). In the same vein, table 3 showed that pre-service STM teachers female group recorded lower mean score (M=10.11, SD= 2.78) in the affective component than their male counterparts (M=10.92, SD=2.54) and this difference was statistically significant (t2098 = -6.89, p<.001). Table 2 equally revealed that pre-service STM teacher female group recorded slightly higher mean score (M=12.95, SD=1.74) in perceived usefulness component than their male counterparts (M=12.93, SD=2.12). However, the difference was statistically not significant (t2098=0.27, p=.789). Concerning behavioural intention component, the pre-service STM teacher female group recorded lower mean score (M=10.67, SD=2.63) than their male counterparts (M=11.37, SD=2.07). This difference in their mean score was statistically significant (t2098=-6.83, p<.001).

The table 3 also showed that pre-service STM teacher female group recorded lower mean score (M=12.56, SD=1.77) in perceived control component than their male counterparts (M=12.83, SD=1.61). This difference in their mean score was statistically significant (t2098=-3.56, p<.001). The table further revealed that pre-service STM teacher female group recorded higher mean score (M=33.73, SD=2.36) in computer self-efficacy than their male counterparts (M=32.67, SD=2.50). However, this difference in their mean score was statistically significant (t2098=10.05, p<.001). Concerning computer anxiety, table 3 showed that pre-service STM teacher female group recorded lower mean score (M=28.72, SD=4.06) than their male counterparts (M=29.05, SD=3.50). However, this difference in their mean score was statistically significant (t2098=-1.97, p=.049). Thus, it is concluded that while gender was a significant factor in pre-service STM teachers' attitudes towards computer even at the subscale levels of affective component, behavioural intention and perceived control it was not a factor in pre-service STM teachers' perceived usefulness component of attitude toward computer. However, gender was a significant factor in pre-service STM teachers' computer self-efficacy and computer anxiety.

Research Question Three: What are the joint and relative contributions of the dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and

behavioural intention), computer anxiety and gender to the explanation of the variance in pre-service teachers' computer self-efficacy?

Table 4 showed that the independent variables (affective component, perceived usefulness component, perceived control, behavioural intention, computer self-efficacy and gender) jointly contributed a coefficient of multiple regression of .841 and multiple correlation square of .707 to the prediction of pre-service STM teachers' computer self-efficacy. By implication, 70.7% of the total variance of the dependent variable (computer self-efficacy) was accounted for by the combination of the six independent variables. The results further revealed that the analysis of variance of the multiple regression data produced and *F-ratio* value significant at 0.01 level (F[6,2093] =103.49; p<.001). The results of the relative contributions of the independent variables to the prediction of pre-service STM teachers was that affective component of attitudes towards computer was the potent significant negative contributor to the prediction of pre-service STM teachers' computer self-efficacy (β=-.26, t=-10.50, p<.001), while behavioural intention component of attitudes toward computer made the next significant negative contribution to the prediction of pre-service STM teachers' computer self-efficacy (β=-.23, t=-10.28, p<.001). Gender (β=-.14, t=-7.07, p<.001) made the next negative contribution to the prediction of pre-service STM teachers' computer self-efficacy. Perceived usefulness component of attitudes toward computer (β=-.11, t=-5.49, p<.001) made the next significant negative contribution to the prediction of pre-service STM teachers' computer self-efficacy. Computer anxiety (β=-.10, t= -4.82, p<.001) and perceived control component of attitudes towards computer (β=-.09, t=-3.99, p<.001) did make the next negative contributions respectively to the prediction of pre-service STM teachers' computer self-efficacy. According to the standardized coefficients the regression model is as follows: Computer anxiety predicted = 41.01 + 0.26 affective component – 0.11 perceived usefulness component - 0.23 behavioural intention component - 0.09 perceived control component - 0.10 computer anxiety - 0.14 gender.

Model summary
Multiple R =.841
Multiple R^2 =.707
Multiple R^2 (adjusted) =.705
Standard error estimate =2.19
$F_{(6, 2093)}$=103.49, p<.001

Model	Unstandardised coefficient		Standardised Coeff	t	Sig
	B	Std Error	Beta		
Constant	41.01	.73		55.98	.000
AFC	-.24	.02	-.26	-10.50	.000
PUC	-.14	.03	-.11	-5.49	.000
BIC	-.24	.02	-.23	-10.28	.000
PCC	-.13	.03	-.09	-3.99	.000
CA	-.06	.01	-.10	-4.82	.000
GENDER	-.69	.10	-.14	-7.07	.000

Table 4. Model summary, coefficient and t-value of multiple regression analysis of attitudes towards computer dimensions, computer anxiety, gender and the outcome measure (computer self-efficacy)

Research Question Four: What is the relative contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer anxiety and gender to the explanation of the variance in pre-service STM teachers' computer self-efficacy?

Next, a stepwise regression analysis was used to determine the contribution of each of these variables in predicting computer self-efficacy. A reduced model explaining the predictive capacity of the six variables (affective component, computer anxiety, perceived control component, gender, behavioural intention, and perceived usefulness component) on computer self-efficacy is outlined in Table 5 below. Model 1, which includes only behavioural intention component of attitudes towards computer scores, accounted for 19.6% of the variance in pre-service STM teachers' computer self-efficacy. The inclusion of affective component into Model 2 resulted in additional 34.6% of the variance is explained. This means that affective component alone accounted for 15.0% of the variance in pre-service STM teachers' computer self-efficacy. The inclusion of gender into Model 3 resulted in additional 47.6% of the variance is explained. This means that gender alone accounted for 13.0% of the variance in pre-service STM teachers' computer self-efficacy. The inclusion of perceived usefulness component of attitudes towards computer into Model 4 resulted in additional 58.6% of the variance is explained. This means that perceived usefulness component alone accounted for 11.0% of the variance in pre-service STM teachers' computer self-efficacy. The inclusion of computer anxiety into Model 5 resulted in additional 66.7% of the variance is explained. This means that computer anxiety alone accounted for 8.1% of the variance in pre-service STM teachers' computer self-efficacy. The inclusion of perceived control component of attitudes towards computer into Model 6 resulted in additional 70.7% of the variance is explained. This means that perceived control component alone accounted for 4.0% of the variance in pre-service STM teachers' computer self-efficacy.

Model	**Independent variables**	**B**	**SEB**	***β***	**t**	**p**	**R**	**R^2**	**F**	**p**
1	Constant	37.58	.24		159.39	.000	.443	.196	359.80	.000
	BIC	-.40	.02	-.38	-18.97	.000				
2	Constant	38.42	.25		153.16	.000	.588	.346	224.49	.000
	BIC	-.30	.02	-.29	-12.84	.000				
	AFC	-.18	.02	-.20	-8.73	.000				
3	Constant	39.20	.27		145.61	.000	.690	.476	171.67	.000
	BIC	-.29	.02	-.28	-12.30	.000				
	AFC	-.17	.02	-.18	-8.14	.000				
	GENDER	-.73	.10	-.15	-7.39	.000				
4	Constant	41.57	.43		97.05	.000	.766	.586	144.26	.000
	BIC	-.27	.02	-.26	-11.77	.000				
	AFC	-.19	.02	-.21	-9.24	.000				
	GENDER	-.73	.10	-.15	-7.43	.000				
	PUC	-.18	.03	-.14	-7.07	.000				
5	Constant	39.53	.63		62.33	.000	.817	.667	120.14	.000
	BIC	-.25	.02	-.24	-10.60	.000				
	AFC	-.20	.02	-.22	-9.70	.000				
	GENDER	-.75	.10	-.15	-7.71	.000				
	PUC	-.16	.03	-.12	-6.12	.000				
	CA	-.06	.01	-.09	-4.33	.000				
6	Constant	41.01	.73		55.98	.000	.841	.707	103.49	.000
	BIC	-.24	.02	-.23	-10.28	.000				
	AFC	-.24	.02	-.26	-10.50	.000				
	GENDER	-.69	.10	-.14	-7.07	.000				

PUC	-.14	.03	-.11	-5.49	.000
CA	-.13	.03	-.09	-4.82	.000
PCC	-.13	.03	-.09	-3.99	.000

Table 5. Summary of stepwise regression results with affective component, behavioural intention, computer anxiety, perceived control component, gender, and perceived usefulness component entered for final model explaining computer self-efficacy.

IV. Discussion

The result of Pearson product-moment correlation coefficient in Table 2 showed that there were significant negative correlations among the dimensions of attitudes toward computer and computer anxiety. Computer anxiety was negatively correlated with computer self-efficacy. Computer self-efficacy was positively correlated with affective component, perceived usefulness and behavioural intention component. Gender was positively correlated with affective component and behavioural intention component but negatively correlated with computer self-efficacy. This result is in line with Awofala, Akinoso, and Fatade (2017) who showed that the dimensions of attitudes towards computer had a significant relationship with computer self-efficacy and computer anxiety. In short, there was a negative relationship between computer self-efficacy and computer anxiety among the pre-service mathematics teachers used for the study. This was in line with the work of Embi (2007) who found that there was an inverse relationship between computer anxiety and computer self-efficacy. More so, Oye, A.Iahad and Ab. Rahim (2012) found an inverse relationship between computer anxiety and computer self-efficacy. It is evident that as attitudes towards use of technology increase, computer self- efficacy also increase and this cause a gradual decrease in computer anxiety (Oye et al, 2012). In a similarly recent study, Roxas-Ridulme (2017) revealed that there was no significant relationship between the students' computer self-efficacy skills and their attitude towards e-learning.

Also, the result of the present study showed that there was a significant influence of gender on pre-service STM teachers' attitudes toward computer, computer anxiety and computer self-efficacy. This agreed with the result of Awofala, Akinoso and Fatade (2017) when they concluded that gender differences in attitude toward computer and computer anxiety among pre-service mathematics teachers were significant. Also, the finding corroborated Awofala, Fatade and Udeani (2015) that gender had significant influence on pre-service science, technology and mathematics teachers' computer self-efficacy. But disagreed with Busch (2005), who investigated gender differences regarding computer attitudes and perceived self-efficacy in the use of computers among 147 college students and concluded that no gender differences were found in computer attitudes or self-efficacy regarding simple computer tasks. The finding also disagreed with Teo (2008) in a survey of pre-service teachers' attitudes towards computer use in Singapore and found no gender or age differences among pre-service teachers on computer attitudes. Okhakhume and Ogunlude (2016) found that gender had no significant influence on students' attitudes towards computer use. Similarly, Cazan, Cocorada, and Maican (2016) found that there were no significant differences between the male and the female participants concerning computer anxiety, self-efficacy and the negative attitudes towards the internet. One possible explanation for the significant gender differences in computer attitude, computer anxiety and computer self-efficacy in the present study might be the mannish specificity of gender roles and not the biological sex as a foundation for these disparities (Huffman, Whetten, & Huffman, 2013).

Moreover, the result of this study showed that the independent variables (affective component, perceived usefulness component, perceived control, behavioural intention, computer anxiety and gender) jointly contributed a coefficient of multiple regression of .841 and multiple correlation square of .707 to the prediction of pre-service STM teachers' computer self-efficacy. By implication, 70.7% of the total variance of the dependent variable (computer self-efficacy) was accounted for by the combination of the six independent variables. The results further revealed that the analysis of variance of the multiple regression data produced and *F-ratio* value significant at 0.001 level ($F[6, 2093] = 103.49$; $p<.001$). The *F-ratio* value is a reliable evidence that combination of the dimensions of attitudes toward computer, computer anxiety and gender in the prediction of pre-service STM teachers' computer self-efficacy from all indications did not occur by chance with 29.3 of the variance in computer self-efficacy unexplained by the current data. Thus there might be other independent variables which may require further investigations about their contribution to the prediction of pre-service STM teachers' computer self-efficacy and the degree of prediction jointly made by the six independent variables of this study could be substantive enough to assert that pre-service STM teachers' computer self-efficacy is predictable by a combination of the dimensions of attitude toward computer, computer anxiety and gender. Thus, the strength of the predictive power of the combined independent variables (perceived usefulness, affective component, perceived control, behavioural intention, computer anxiety and gender) on the outcome variable was strong and significant to show the linear relationship between the six predictor variables and the total variance in pre-service STM teachers' computer self-efficacy. That computer anxiety predicted computer self-efficacy in the present study coincided with the result of Barbeite and Weiss (2004) in which computer anxiety was a significant predictor of self-efficacy for advanced activities and was significantly correlated with several indicators of computer and Internet use. The positive relationship between computer self-efficacy and attitudes toward computer in this study agreed with findings of the studies that have shown positive relationship between computer self-efficacy and attitudes toward computer (Anderson, Groulx, & Maninger, 2011; Brinkerhoff, 2006; Taghavi, 2006; Koseoglu, Yilmaz, Gercek, & Soran, 2007; Pamuk, & Peker, 2009).

The result of the stepwise regression analysis revealed that all the six (affective component, perceived control component, perceived usefulness component, behavioural component and gender) independent variables made a statistically significant contribution to the variance in pre-service STM teachers' computer self-efficacy. Behavioural intention component of attitudes towards computer accounted for 19.6% of the variance in pre-service STM teachers' computer self-efficacy. This was followed by the affective component which alone accounted for 15.0% of the variance in pre-service STM teachers' computer self-efficacy. This was followed by gender which alone accounted for 13.0% of the variance in pre-service STM teachers' computer self-efficacy. This was followed by perceived usefulness component of attitudes towards computer which alone accounted for 11.0% of the variance in pre-service STM teachers' computer self-efficacy. This was followed by computer anxiety which alone accounted for 8.1% of the variance in pre-service STM teachers' computer self-efficacy. This was followed by perceived control component which alone accounted for 4.0% of the variance in pre-service STM teachers' computer self-efficacy.

V. Recommendation

It is no doubt, that an individual computer anxiety may have thoughtful effect on his/her efficiency with computer technology. Therefore, educational institutions in Nigeria should devise means of combatting this anxiety in students so that meaningful e-learning experience can be created. By

magnificently decreasing computer anxiety among computer users, pre-service STM teachers inclusive will stimulate a myriad number of benefits to them. Aside from gaining efficacy in computer usage, pre-service STM teachers will also exhibit positive computer attitudes. Pre-service STM teachers should be given the necessary training in usage of computer devices so that they become familiar with modern pedagogy of imparting knowledge and skills. The level of pre-service STM teachers' literacy in usage of computer should be enhanced by creating awareness through the media and by developing a positive attitude towards the application of computer devices in tertiary institutions. Conclusively, more investigations should be carried out on strategies that could deepen and enhance pre-service STM teachers' attitude and self-efficacy and lessen or reduce anxiety about computer technology in universities.

VI. Conclusion

This study has shown that attitudes toward computer and computer anxiety are robust correlating factor with computer self-efficacy. Also, students' gender is a recurrent issue that needs more research since evidence suggests inconclusive results regarding gender effect in technology usage. Students will be less effectual despite the worthwhileness of computer technology if they are challenged with threats which relate to technology anxiety (Fatemi Jahromi, Forouzan, & Gholaminejad, 2017; Awofala, Akinoso & Fatade, 2017). As significant drivers of change in the educational institutions, teachers at all levels play a significant role in technology integration in the teaching and learning process in the classroom. Therefore, teachers must display strong and positive attitudes toward computer technology since attitude is significantly associated with usage and intention to adopt technology in the classroom. Attitudes toward technology whether positive or negative have strong influence on how teachers act in response to technology in the school and this, in turn, affects the way students react to technology in the classrooms (Teo, 2006).

In Nigeria, the level of technology adoption in schools is increasing and the extent to which it is put to significant use is a product of teachers holding positively meaningful attitude towards it (Awofala, Akinoso, & Fatade, 2017; Huang & Liaw, 2005). Thus, ample opportunities should be given to the pre-service STM teachers to engross in the usage of computer for instructional purpose. Teacher educators should help pre-service STM teachers to experience success in using computer in a conducive and non-threatening environment to make them garner experience, competence and efficacy in adopting technologies for teaching and learning when they become teachers in schools.

Despite the large sample size, this study has several limitations. First, the data collected were through self-reports which have been criticize for being subjective. Second, this study suffers from the problem of temporality as it is practically difficult for investigators to determine the temporal sequence between the independent and the dependent variables. This is because it is difficult to tell whether the dependent variable precedes the independent variable or vice-versa. Third, data collected through self-reports often lead to a common method variance, a condition that may blow up the real relationships between variables, causing unauthentic significant findings. Fourth, respondents might have lied due to social desirability. Most people may want to present a positive image of themselves and so may have lied or bent the truth in their responses. Fifth, though the self-report measures provide a relatively cheap, quick and efficient way of obtaining large amount of information from a large sample of people, they lack detail as responses are fixed thereby giving less scope for respondents to supply answers reflecting their true feelings on computer self-efficacy, computer

anxiety and attitudes toward computer. Given these shortcomings, the results of this study must be treated with caution.

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