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ATTITUDES TOWARDS COMPUTER AND COMPUTER SELF-EFFICACY AS PREDICTORS OF PRESERVICE MATHEMATICS TEACHERS' COMPUTER ANXIETY

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Abstract: The study investigated attitudes towards computer and computer self-efficacy as predictors of computer anxiety among 310 preservice mathematics teachers from five higher institutions of learning in Lagos and Ogun States 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 factor analysis, independent samples t-test, Pearson product moment correlation coefficient and multiple regression analysis. Finding revealed that attitude toward computer assessed by the attitudes towards computer scale was a multi-dimensional construct (affective, perceived usefulness, behavioural intention and perceived control component). Gender differences in attitude toward computer and computer anxiety among preservice mathematics teachers were significant. Affective component, computer self-efficacy, perceived control component, and perceived usefulness component made statistically significant contributions to the variance in preservice mathematics teachers' computer anxiety. 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, so that positive e-learning experiences can be created for preservice teachers.

Key words: Computer attitude, computer self-efficacy, computer anxiety, preservice mathematics teacher.

1. Introduction

Feeling nervous about a situation is referred to as anxiety. Many people feel nervous when faced with a problem at work, before taking a test, or making an important decision. Also, students are afraid of some courses like mathematics, computer or any course that is mathematically oriented. Meanwhile, the use of ICT in education pervades all levels of education especially at the tertiary level. Before students can gain admission to any tertiary institution, purchase of form and registration are done online while entrance examination is done on computer. In higher institutions, ICT is increasingly used as a means of delivering subject matter contents. Some educational institutions have added on-line learning and blended learning models to the face-to-face education to broaden their scope of delivering education to their clienteles (Senzige & Sarukesi, 2001).

Consequently, a senior secondary school student aspiring to have a university education must possess basic knowledge and skills in ICT. It is, therefore, incumbent on senior secondary school students not only to possess adequate competence in ICT but also possess positive attitudes toward the learning of the subject to enable them have fruitful education when they eventually gain admission into tertiary institutions. There are different symptoms of anxiety like feelings of panic, fear and sweaty hands or feet, shortness of breath heart palpitations, dried mouth and tingling in the

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hands or feet but the cause of anxiety is not known but could be caused by combination of factors like change in brain and environmental stress.

Computer anxiety is the feeling uncomfortable when using computer. The anxious person may have some negative thoughts, sweaty hand and increased heart rate or want to avoid working with a computer. One may have operational anxiety which includes previous experiences, frequency of computer use and having a personal computer. Sociological anxiety is in form of gender, age, ethnicity, academic major, nationality and socio-economic status, while psychological anxiety include attitude toward computers, self-perception, self-efficacy and personality types. Students with positive thought about computer will see errors when committed as a challenge to be beaten, enjoy learning new tricks and have positive view of the interaction with computer. The contributory factors to computer anxiety according to Rahimi and Yadollahi (2011) are context, history and personality. Since insufficient knowledge and skills in computer acquirable by students may have effect on their learning in tertiary institution, it becomes necessary to find a way of addressing the issue of computer anxiety in preservice teachers of mathematics so as to transfer the knowledge to the students on getting to the field. Addressing the issue of computer anxiety will help preservice teachers of mathematics learn computer skills and use computers with ease.

Previous studies on computer anxiety have shown that the construct of computer anxiety has a significant effect on computer-related activities such as computing skills (Harrison & Rainer, 1992), computer use (Igbaria & Parasuraman, 1989), intentions to use computers or software applications (Elasmar & Carter, 1996), attitudes toward computers (Teo, 2008; Compeau & Higgins, 1995), and perceived ease of use (Venkatesh, Morris, & Ackerman, 2000). These findings revealed that computer anxiety increases resistance to computer technology and represents a barrier to an individual’s involvement with computers (Arigbabu, 2009; Howard & Smith, 1986).

In carrying out any task, belief or confidence someone has about the capability possessed is very important and this plays important roles about the success attain in such task. Self-efficacy is grounded in the theoretical framework of social cognitive theory emphasizing the evolvement and exercise of human agency that people can exercise some influence over what they do (Bandura, 2006). Self-efficacy according to Bandura (1994) is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Bandura (2006) maintains that in this conception, people are self-organizing, proactive, self-regulating, and self-reflecting. From this perspective, self-efficacy affects one's goals and behaviours and is influenced by one's actions and conditions in the environment (Schunk & Meece, 2006).

Self-efficacy beliefs determine how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes which include cognitive, motivational, affective and selection processes. A strong sense of efficacy enhances human accomplishment and personal well-being in many ways. Individual with high assurance in their capabilities approach difficult tasks as challenges to be mastered rather than as threats to be avoided. Such an efficacious outlook fosters intrinsic interest and deep engrossment in activities. Bandura (1994) emphasized further that people with self-efficacy set themselves challenging goals and maintain strong commitment, heighten and sustain their efforts in the face of failure and recover quickly the sense of efficacy after setbacks. The development of self-efficacy beliefs seems to be more influenced by mastery experiences than information formed by social comparisons (Steyn & Mynhardt, 2008). Invariably, computer self-efficacy is the beliefs of people about their capabilities to produce designated levels of performance on computer.

Evidence suggests that technology use by an individual is being moderated by his/her self-efficacy belief. For instance Compeau and Higgins (1995) reported that an individual’s use of technology was influenced by their self-efficacy and those individuals with higher self-efficacy beliefs made use of computers more often and experienced less computer-related anxiety than those with lower self-efficacy beliefs. The authors also noted that individuals with higher computer self-efficacy beliefs incline to see themselves as able to use computer technology with less anxiety while those with lower computer self-efficacy beliefs incline to become more frustrated and anxious when working with computers and vacillate to use computers when they bump into obstacles.

Computer self-efficacy has a significant effect on an individual's expectations towards using computers (Compeau & Higgins 1995) and individuals who did not see themselves as capable of using the computer incline not to use computers (Oliver & Shapiro 1993). It is clear that computer self-efficacy promotes performance and lessens computer induced anxiety (Burkhardt & Brass 1990; Harrison & Rainer 1997) among users and that teachers' computer self-efficacy is a major influence shaping their patterns of computer use (Albion, 2001). In addition, computer self-efficacy significantly predicted pre-service teachers' ability to integrate technology use in the classroom (Litterell, Zagumny, & Zagumny, 2005; Zhao, Pugh, Sheldon, & Byers, 2002).

Positive disposition towards computers is a prerequisite and catalyst to acquiring a high level of computer literacy and successful pedagogical use of technology (Francis, Katz, & Jones, 2000). The teacher is a means to effective implementation of the use of computers in the educational system and teachers must have tremendous potential to transmit beliefs and values to students, it is important to understand the factors that contribute to both positive and negative attitude of teachers to computer usage. In support of the importance of teachers' attitudes towards computer use, Zhao, Tan, and Mishra (2001) provided evidence to suggest that the attitudes of teachers are directly related to computer use in the classroom. In this case, attitude of the pre-service teachers becomes an important issue that needs investigation. Success in students' learning with computer technology will be a function of their teachers' attitudes and their disposition to embrace the technology (Teo, 2006). Teachers' attitudes towards computer use may deliver important insights into technology integration and acceptance and usage of technology in teaching and learning (Teo, 2008a) process. Nearly in all developing countries of the world, most schools are ill-equipped with the structure to carry out ICT mediated teaching and learning as opposed to the developed countries where schools are fortified with infrastructure to conduct computer mediated instruction. Positive teachers' attitudes towards computer are essential if computer technologies are to be efficiently used and integrated into the school curriculum (Teo, 2008a). Teachers' attitude towards computer use is vital because it is a significant predictor of future computer use in the classroom (Myers & Halpin, 2002). In a study by Khine (2001) which involved 184 preservice teachers showed a significant relationship between computer attitude and its use in the instruction. Kumar and Kumar (2003) found that most teachers believe that the amount of computer experience has a positive influence on attitude towards computers. Yuen and Ma (2002) studied computer attitude using the Chinese Computer Attitude Scale for Teachers (CAST) among 216 secondary teachers in Hong Kong and reported the instructional use of computers and their findings showed that affective attitudes, general usefulness, behavioural control, and pedagogical use to be significant in determining the use of ICT in teaching and learning.

On gender and attitude, Birisci, Metin and Karakas (2009) found no significant difference in attitudes towards computers based on gender, but female participants in the study were more positively disposed to using internet than men. Teo (2008a) found no significant influence of gender on preservice teachers' computer attitude. Female are more anxious or less experienced, less confident in ICT competence (Rekabdarkolaei & Amuei, 2008). Though, majority of positions relating to computers are occupied by male teachers but, there was no relationship between gender and teachers' computer use (Mehloff, 2001). Jackson, Ervin, Gardner and Schmitt (2001) found that female users, compared with males, tend to hold negative reactions to computer technologies and such differences may have contributed to the different ways of using computer technologies. The research on the effect of gender on computing has often been reported, though not convincingly, that males showed more experience and were friendlier with the use of computers (Brosnan & Lee, 1998; Balka & Smith, 2000). Chua, Chen and Wong (1999) and Coffin and Mackintyre (2000) in their meta-analyses on the relationships among computer anxiety, computer attitudes, computer self-efficacy and computer experience retorted that most findings usually promote the gender effects and indicated that greater levels of computer experience were correlated with lower computer experience and more positive computer attitudes. Females often displayed more negative attitudes towards computers (Durndell & Thompson, 1997) and showed higher computer anxiety (McIlroy, Bunting, Tierney & Gordon, 2001) 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 (Todman, 2000).

1.1 Purpose of the study

The central purpose of this research work was to investigate attitudes towards computer and computer self-efficacy as predictors of pre-service mathematics teachers' computer anxiety.

1.2 Objectives of the study

The objectives of this study include:

1. To determine the factor structure of the attitudes towards computer scale for pre-service mathematics teachers.
2. To investigate the relationships among attitudes towards computer, computer anxiety and computer self-efficacy of pre-service mathematics teachers.
3. To determine the influence of gender on pre-service mathematics teachers' attitude towards computer, computer anxiety and computer self-efficacy.
4. To examine the joint contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer self-efficacy and gender to the explanation of variance in pre-service mathematics teachers' computer anxiety.
5. To examine the relative contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer self-efficacy and gender to the explanation of variance in pre-service mathematics teachers' computer anxiety.

1.3 Research questions

RQ1. What is the factor structure of attitudes towards computer scale among preservice mathematics teachers?

RQ2. What is the relationship among attitudes towards computer, computer anxiety and computer self-efficacy among pre-service mathematics teachers?

RQ3. What is the influence of gender on pre-service mathematics teachers' attitude towards computer, computer anxiety and computer self-efficacy?

RQ4. What is the joint contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer self-efficacy and gender to the explanation of variance in pre-service mathematics teachers' computer anxiety?

RQ5. What is the relative contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer self-efficacy and gender to the explanation of variance in pre-service mathematics teachers' computer anxiety?

1.4 Null hypotheses

HO_1 There is no significant relationship among attitudes towards computer, computer anxiety and computer self-efficacy of mathematics physics teachers.

HO_2. There is no significant influence of gender on pre-service mathematics teachers' attitudes towards computer, computer anxiety and computer self-efficacy.

HO_3. There is no significant joint contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer self-efficacy and gender to the explanation of variance in pre-service mathematics teachers' computer anxiety.

HO_4 There is no significant relative contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer self-efficacy and gender to the explanation of variance in pre-service mathematics teachers' computer anxiety.

2. Methods

2.1 Research design

The study made use of quantitative research method within the blueprint of the descriptive survey design. A survey research method was used for this study because it is used to assess thoughts, opinions, and feelings.

2.2 Population of the study

The population of this study comprised preservice teachers in higher institutions who study mathematics education as major course in Lagos and Ogun States of Nigeria.

2.3 Participants

The participants in this study were 310 preservice mathematics teachers (127 males and 183 females) randomly selected from five institutions of higher education in Lagos and Ogun States, Nigeria. Their age ranged from 16 to 34 years with mean age of 21.8 years. The participants could also be categorised as 127 (40.97%) within the age bracket below 20 years and 183 (59.03%) within the age bracket 20-34 years. 78 (25.16%) were in first year [32 (41.03%) males, 46 (58.97%) females, *M*age = 19.5 years, *SD* = 2.4, age range: 16-25 years], 78 (25.16%) were in second year [32 (41.03%) males, 46 (58.97%) females, *M*age = 21.4 years, *SD* = 2.8, age range: 17-30 years], 78 (25.16%) were in third year [32 (41.03%) males, 46 (58.97%) females, *M*age = 22.4 years, *SD* = 3.1, age range: 18-32 years], and 76 (24.52%) were in fourth year [31 (40.79%) males, 45 (59.21%) females, *M*age = 21.3 years, *SD* = 2.9, age range: 19-34 years].

2.4 Research instruments

Three instruments, 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. 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 between 21 and 84. In this study, the negative items were reversed coded in order that meaningful analyses at the sub-scale level could be conducted. 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 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.

2.5 Validity and reliability of research instruments

The three instruments (ATCS, CARS, & CSES) were subjected to face validity by two experts in measurement and evaluation for appropriateness for the study in order to fine-tune and scrutinize the research instruments. The ATCS has been found to be a reliable instrument to measure attitude towards computer among teacher education students. Using the ATCS on 131 undergraduate students in early childhood education, Sexton, King, Aldridge and Goodstadt-Killoran (1999) reported that the ATCS possessed high reliability (alpha = 0.90). 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. In the present study the three instruments were pilot tested on a sample of 40 preservice mathematics 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 0.94, 0.86, and 0.88 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.

2.6 Method of data collection

The researchers together with four research assistants administered the ATCS, CAS, and CSES to the whole sample and in a regularly scheduled class in the five institutions of higher education for the purpose of this study.

2.7 Data analysis

Data collected were summarized and analysed using principal components factor analysis, analysis of variance (ANOVA), Pearson's product moment correlation, independent samples t-test and multiple regression analysis at α=0.05 level of significance.

3. Results

3.1 Research question one: What is the factor structure of attitudes towards computer scale among preservice mathematics teachers?

For research question 1 the responses of the participants to the 21 items of attitudes towards computer scale were subjected to principal components factor analyses (PCA) to identify their underlying dimensions. The data screening processes were carried out and showed no missing values for the 310 participants. Subsequently, further screening showed no concern about normality, linearity, multicollinearity, and singularity. For example, scale scores were normally distributed with skewness and kurtosis values within acceptable ranges (e.g. skewness ranged from -.702 to 0.843, kurtosis ranged from -1.054 to .446) as Kline (1998) suggested using absolute cut-off values of 3.0 for skewness and 8.0 for kurtosis. The correlation matrix of the 21 items revealed that the correlations when taken overall were statistically significant as indicated by the Bartlett's test of sphericity, $\chi 2 = 1091.117;\ df=210;\ p<.001$ which tests the null hypothesis that the correlation matrix is an identity matrix. The Kaiser-Meyer-Olkin measure of sampling adequacy (MSA) fell within acceptable range (values of .60 and above) with a value of .805. Each of the variables also exceeded the threshold value (.60) of MSA which ranged from .720 to .802. Finally, most of the partial correlations were small as indicated by the anti-image correlation matrix. These measures all led to the conclusion that the set of 21 items of attitudes toward computer scale was appropriate for PCA and since no particular number of components was first hypothesized the criterion was set to eigenvalues greater than one (Kaiser, 1960; Tabachnick & Fidell, 2007). The initial unrotated PCA resulted in a factor model of four dimensions as indicated by the eigenvalues exceeding unity while the scree plot also showed a factor model of four dimensions. However, based on its pattern of factor loadings, this unrotated factor model was theoretically less meaningful and as such was difficult to interpret. Therefore, the analysis proceeded to rotate the factor matrix orthogonally using varimax rotation to achieve a simple and theoretically more meaningful solution. The rotation resulted in a factor model of four dimensions as suggested by the scree plot and eigenvalues exceeding unity.

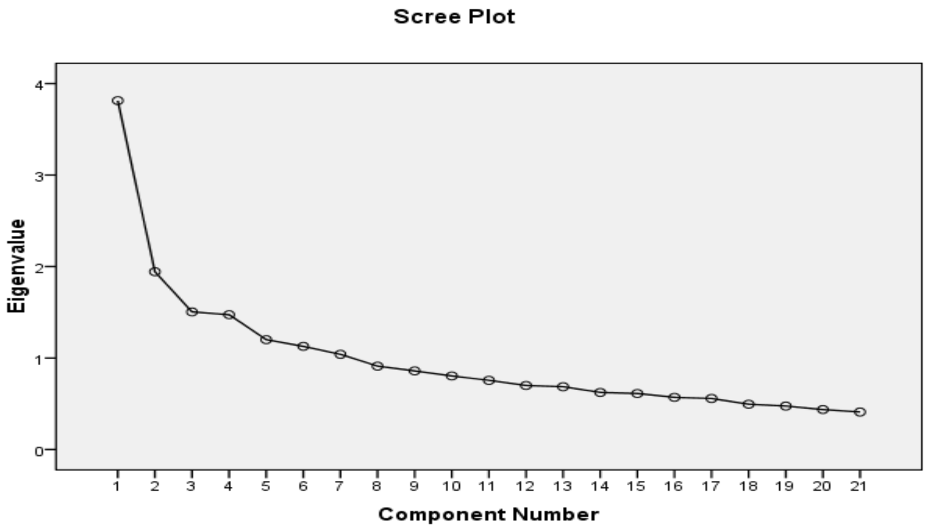

Figure 1. *Cattell scree plot showing number of components and eigen-values of the correlation matrix*

Table 1. *Mean and standard deviation and summary of factor loadings by principal components analysis for the orthogonal four factor model*

A. Affective Component Factor 1	**M**	**SD**	**Factor loading**	h^2
1. If given the opportunity to use a computer, I am afraid that I might damage it in some way*	1.43	.681	.608	.509
2. I hesitate to use a computer for fear of making mistakes I can't correct*	2.28	1.013	.770	.607
3. I don't feel apprehensive about using a computer	2.82	.958	.746	.778
4. Computers make me feel uncomfortable*	3.40	.818	.678	.516
5. Using a computer does not scare me at all	3.43	.848	.876	.698
6. I hesitate to use a computer in case I look stupid*	2.68	.975	.768	.586
Sub-total	**2.67**	**.8822**		
B. Perceived Usefulness component Factor 2				
7. Computers help me improve my work better	2.53	.946	.615	.765
8. Computers make it possible to work more Productively	2.14	.885	.629	.645
9. Computers can allow me to do more interesting and imaginative work	2.06	.789	.876	.764
10. Most things that a computer can be used for I can do just as well myself*	2.82	.858	.874	.698
11. Computers can enhance the presentation of my work to a degree which justifies the extra effort	2.68	.995	.687	.576
Sub-total	**2.45**	**.8946**		
C. Perceived Control Component Factor 3				
12. I could probably teach myself most of the things I need to know about computers	1.79	.815	.812	.863
13. I can make the computer do what I want it to	1.61	.717	.764	.673
14. If I get problems using the computer, I can usually solve them one way or the other	3.07	.856	.875	.672
15. I am not in complete control when I use a				

computer*	2.40	.973	.764	.681
16. I need an experienced person nearby when I use a computer	3.16	.884	.872	.761
17. I do not need someone to tell me the best way to use a computer	3.29	.960	.784	.719
Sub-total	**2.55**	**.8675**		
D. Behavioural Intention component Factor 4				
18. I would avoid taking a job if I knew it involved working with computers*	1.79	.733	.812	.714
19. I avoid coming into contact with computers in school*	2.80	.897	.672	.556
20. I only use computers at school when I am told to*	2.81	.937	.708	.715
21. I will use computers regularly throughout school.	3.26	.984	.807	.779
Sub-total	**2.67**	**.8878**		
Total	**2.59**	**.8830**		

* Item for which scoring is reversed.

In this study, all the communalities for the factor analysis satisfied the minimum requirement of being larger than 0.50, in fact these ranged from 0.509 to 0.863. Figure 1 above is the scree plot which graphs the eigenvalue against the component number and is suggestive of a four component model.

Table 1 displayed the factor loadings for the orthogonal four-factor model of attitudes toward computer scale. All items loaded .608 and above on their primary factor; none of the secondary loadings exceeded .30. Together the four factors accounted for 41.592% of the total variance. The first factor accounted for 18.160% of the variance (eigenvalue= 3.814) and consisted of six affective component items. The second factor accounted for 9.254% of the variance (eigenvalue = 1.943) and consisted of four five perceived usefulness component items. The third factor accounted for 7.162% of the variance (eigenvalue = 1.504) and consisted of six perceived control component items. The fourth factor accounted for 7.017% of the variance (eigenvalue = 1.474) and consisted of four behavioural intention component items. The internal consistency reliabilities for the subscales are: affective component (α = .870), perceived usefulness component (α = .781), perceived control component (α = .909) and behavioural intention component (α = .822), and the internal consistency reliability for the entire scale (α = .840) was considered very high and conceptually meaningful (Curtis & Singh, 1997). Thus, the four measures represent empirically separable and internally consistent attitudes toward computer constructs.

3.2 Null hypothesis one: There is no significant relationship among attitudes towards computer, computer anxiety, and computer self-efficacy of preservice mathematics teachers.

Table 2 showed the relationships among attitudes towards computer, computer anxiety and computer self-efficacy of the preservice mathematics teachers. The results of Pearson Product Moment Correlation coefficient showed that there were significant positive correlations among the dimensions of attitudes toward computer and computer anxiety. Computer self-efficacy was negatively correlated with computer anxiety. Gender only had significant negative correlations with perceived usefulness component and behavioural intention component of attitudes toward computer.

Table 2. *Mean, standard deviation, and intercorrelations among attitudes towards computer, computer self-efficacy and computer anxiety of preservice mathematics teachers for total sample (n=314)*

Variables

	1	2	3	4	5	6	7
1. AFC	1.00						
2. PUC	.232**	1					
3. BIC	.203**	.203**	1				
4. PCC	-.409**	.255**	.486**	1			
5. CA	.339**	.277**	.211**	.327**	1		
6. CSE	-.090	-.007	-.034	-.033	-.181**	1	
7. GENDER	-.073	-.135*	-.191**	-.097	-.107	.042	1
Mean	16.04	12.20	8.72	16.08	53.09	15.17	1.61
Standard deviation	2.80	2.43	1.61	2.63	11.63	6.29	.51

**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.

3.3 Null hypothesis two: There is no significant influence of gender on pre-service mathematics teachers' attitudes towards computer, computer anxiety and computer self-efficacy.

Table 3 below 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 preservice mathematics teachers. With respect to the aggregate attitudes towards computer score, the female group recorded a lower mean score (M=45.29, SD=5.74) than their male counterparts (M=47.27, SD=5.83). However, this difference in mean score was statistically significant (t_{308}=2.96, p=.003). Table 3 below showed that the preservice mathematics teacher female group recorded lower mean score (M=15.81, SD=2.94) in affective component than their male counterparts (M=16.34, SD=2.58) and this difference was statistically not significant (t_{308}=1.64, p=.102).

Table 3. *Independent samples t-test analysis of preservice mathematics teachers' attitudes towards computer, computer anxiety and computer self-efficacy according to gender.*

	Gender	N	M	SD	Df	t	p
AFC	Male	127	16.34	2.58	308	1.64	.102
	Female	183	15.81	2.94			
PUC	Male	127	12.59	2.54	308	2.32*	.021
	Female	183	11.94	2.32			
BIC	Male	127	9.09	1.78	308	3.32*	.001
	Female	183	8.48	1.43			
PCC	Male	127	16.47	2.71	308	2.37*	.018
	Female	183	15.76	2.53			
CA	Male	127	54.75	10.86	308	2.14*	.033
	Female	183	51.87	12.10			
CSE	Male	127	14.54	6.40	308	-1.79	.075
	Female	183	15.81	6.02			
ATC	Male	127	47.27	5.83	308	2.96*	.003
	Female	183	45.29	5.74			

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

In Table 3, the preservice mathematics teacher female group recorded lower mean score (M=11.94, SD=2.32) in perceived usefulness component than their male counterparts (M=12.59, SD=2.54). The difference was statistically significant (t_{308}=2.32, p=.021). With respect to behavioural intention component, the preservice mathematics teacher female group recorded lower mean score (M=8.48, SD=1.43) than their male counterparts (M=9.09, SD=1.78). However, this difference in mean score was statistically significant (t_{308}=3.32, p=.001). Table 3 revealed that preservice mathematics teacher female group recorded lower mean score (M=15.76, SD=2.53) in perceived control component than their male counterparts (M=16.47, SD=2.71). This difference in mean score was statistically significant (t_{308}=2.37, p=.018). With respect to computer anxiety, the preservice mathematics teacher female group recorded lower mean score (M=51.87, SD=12.10) than their male counterparts (M=54.75, SD=10.86). However, this difference in mean score was statistically significant (t_{308}=2.14, p=.033). With respect to computer self-efficacy, the preservice mathematics teacher female group recorded higher mean score (M=15.81, SD=6.02) than their male counterparts (M=14.54, SD=6.40). However, this difference in mean score was statistically not significant (t_{308}=-1.79, p=.075). Thus, it is concluded that while gender was a significant factor in preservice mathematics teachers' computer anxiety and attitudes towards computer and even at the subscale levels of perceived usefulness, behavioural intention, and perceived control it was not a factor in preservice mathematics teachers' computer self-efficacy.

3.4 Null hypothesis three: There is no significant joint contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer self-efficacy and gender to the explanation of variance in pre-service mathematics teachers' computer anxiety.

The results in Table 4 below showed that the independent variables (perceived usefulness, affective component, perceived control, and behavioural intention, computer self-efficacy and gender) jointly contributed a coefficient of multiple regression of .484 and a multiple correlation square of .234 to the prediction of preservice mathematics teachers' computer anxiety. By implication, 23.4% of the total variance of the dependent variable (computer anxiety) 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 an *F*-ratio value significant at 0.001 level ($F_{(6,\ 307)}$ = 15.70; *p*<.001). The results of the relative contributions of the independent variables to the prediction of preservice mathematics teachers' computer anxiety was that affective component of attitudes toward computer was the potent significant positive contributor to the prediction of preservice mathematics teachers' computer anxiety (β = .239, *t* = 4.296, *p*<.001), while computer self-efficacy made the next significant positive contribution to the prediction of the dependent variable (β =.213, *t* = 4.237, *p*<.001). Perceived usefulness component of attitudes toward computer (β =.164, *t* = 3.114, *p*=.002) and perceived control component of attitudes toward computer (β =.167, *t* = 2.708, *p*=.007) did make significant positive contributions to the prediction of preservice mathematics teachers' computer anxiety. Behavioural intention component of attitudes toward computer (β =.045, *t* = 0.780, *p*=.436) and gender (β =-.051, *t* =-1.006, *p*=.315) did not make any positive or negative contributions to the prediction of preservice mathematics teachers' computer anxiety.

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

Model summary
Multiple R =.484
Multiple R^2 =.234
Multiple R^2 (adjusted) =.219
Standard error estimate =10.27
$F_{(6,\ 307)}$=15.67 , p<.001

Model	Unstandardised coefficient		Standardised Coeff	t	Sig
	B	Std Error	Beta		
Constant	8.77	5.70		1.54	.125
AFC	.992	.231	.239	4.30	.000
PUC	.785	.252	.164	3.11	.002
BIC	.328	.420	.045	.780	.436
PCC	.739	.273	.167	2.71	.007
CSE	.393	.093	.213	4.24	.000
GENDER	-1.16	1.157	-.051	-1.01	.315

3.5 Null hypothesis four:

There is no significant relative contribution of dimensions of attitudes towards computer (perceived usefulness, affective component, perceived control, and behavioural intention), computer self-efficacy and gender to the explanation of variance in pre-service mathematics teachers' computer anxiety.

Afterwards, a stepwise regression analysis was used to determine the contribution of each of these variables in predicting computer anxiety. A reduced model explaining the predictive capacity of the four variables (affective component, computer self-efficacy, perceived control component, and perceived usefulness component) on computer anxiety is outlined in Table 5 below. Model 1, which includes only affective component of attitudes towards computer scores, is accounted for 11.5% of the variance in preservice mathematics teachers' computer anxiety. The inclusion of computer self-efficacy into Model 2 resulted in additional 16.0% of the variance being explained. This means that computer self-efficacy alone accounted for 4.5% of the variance in preservice mathematics teachers' computer anxiety. The inclusion of perceived control component of attitudes toward computer into Model 3 resulted in additional 20.2% of the variance being explained. This means that perceived control component alone accounted for 4.2% of the variance in preservice mathematics teachers' computer anxiety. The inclusion of perceived usefulness component of attitudes towards computer into Model 4 resulted in additional 23.0% of the variance being explained. This means that perceived usefulness component alone accounted for 2.8% of the variance in preservice mathematics teachers' computer anxiety.

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

Model	Independent variables	B	SEB	β	t	p	R	R^2	F	p
1	Constant	30.47	3.61		8.45	.000	.339	.115	40.50	.000
	AFC	1.409	.221	.339	6.36	.000				
2	Constant	23.23	3.94		5.90	.000	.400	.160	29.59	.000
	AFC	1.49	.217	.358	6.86	.000				
	CSE	.394	.096	.213	4.08	.004				
3	Constant	13.42	4.55		2.95	.000	.449	.202	26.16	.000
	AFC	1.11	.232	.266	4.77	.000				
	CSE	.392	.094	.212	4.17	.005				
	PCC	.994	.246	.225	4.04	.005				
4	Constant	7.51	4.82		1.56	.120	.479	.230	23.03	.000
	AFC	.994	.231	.239	4.31	.000				
	CSE	.388	.093	.210	4.19	.000				
	PCC	.846	.246	.192	3.44	.001				
	PUC	.832	.250	.174	3.33	.001				

3.6 Summary of findings

1. Attitude toward computer was a multi-dimensional construct consisting of four factors (perceived usefulness, affective component, perceived control, and behavioural intention).
2. There was a significant relationship among attitudes toward computer, computer anxiety and computer self-efficacy of pre-service mathematics teachers.
3. There was a significant influence of gender on preservice mathematics teachers' attitudes toward computer and computer anxiety and not on computer self-efficacy.
4. The independent variables (perceived usefulness, affective component, perceived control, and behavioural intention, computer self-efficacy and gender) jointly contributed a coefficient of multiple regression of .484 and a multiple correlation square of .234 to the prediction of preservice mathematics teachers' computer anxiety. By implication, 23.4% of the total variance of the dependent variable (computer anxiety) was accounted for by the combination of the six independent variables.

5. Affective component of attitudes toward computer scores accounted for 11.5% of the variance in preservice mathematics teachers' computer anxiety.
6. Computer self-efficacy alone accounted for 4.5% of the variance in preservice mathematics teachers' computer anxiety.
7. Perceived control component alone accounted for 4.2% of the variance in preservice mathematics teachers' computer anxiety.
8. Perceived usefulness component alone accounted for 2.8% of the variance in preservice mathematics teachers' computer anxiety.

4. Discussion

The results of the present study have shown five main findings. These findings relate to establishing the factor structure of the attitudes toward computer scale with preservice mathematics teachers; determining the relationship between the attitudes toward computer, computer anxiety and computer self-efficacy of preservice mathematics teachers; determining whether differences existed between male and female preservice mathematics teachers in attitudes toward computer, computer anxiety and computer self-efficacy; and ascertaining the composite and the relative contributions of attitudes toward computer, computer self-efficacy and gender to the prediction of preservice mathematics teachers' computer anxiety.

The result of the present study showed that attitude toward computer as measured by the attitude toward computer scale is a multi-dimensional construct. The exploratory factor analysis using the principal components analysis showed a four factor structure underlying the scale. The four interpretable factor structures are subsequently labelled: affective component (with 6 items), perceived usefulness component (with 5 items), behavioural intention component (with 6 items) and perceived control component (with 4 items) and each subscale had adequate internal consistency reliability. This is in line with Teo (2008a) who empirically envisioned the multi-dimensional nature of the attitudes toward computer scale. In the present study, the preservice mathematics teachers showed a high level of attitude toward computer (Mean=2.59, SD=0.8830).

The finding relating to the relationship among attitudes towards computer, computer self-efficacy and computer anxiety showed that in the present study the dimensions of attitudes towards computer had 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 preservice mathematics teachers. This was in line with the work of Embi (2007) who found out that there was an inverse relationship between computer anxiety and computer self-efficacy.

The results shown in Table 3 indicated that gender was a factor in preservice mathematics teachers' attitudes towards computer and computer anxiety but not in computer self-efficacy. The male and female preservice teachers recorded different mean scores in computer anxiety and attitude toward computer and its dimensions. Thus, gender differences in attitudes towards computer and computer anxiety as shown in this study were significant. This result coincided with the results of previous study (Teo, 2008a, 2008b). This finding did agree with the past research findings which indicated significant effects of gender on computer attitudes (Margolis & Fisher, 2002; Markauskaite, 2006). For instance, Houtz and Gupta (2001) showed that both genders (males and females) had rated themselves on their ability to use the computer in significantly different ways. However, other studies have indicated that the unfeminine image of the computer has prevented female folks from deriving benefits from the computer technology and this has made the female gender less confident or more anxious (Culley, 1988), and thus cumulating in females showing more negative attitudes to computers than males (Campbell, 1990). In short, female folks have the inclination to use computer technologies less often even when given equal access (Muira, 1987).

The results displayed in Table 4 showed that the six predictor variables (perceived usefulness, affective component, perceived control, behavioural intention, computer self-efficacy and gender) taken together accounted for 23.4% of the variance in preservice teachers' computer anxiety. The relationship between computer anxiety and the predictor variables taken together were high as shown by the coefficient of multiple correlation (*R* = .484). Thus, the predictor variables investigated predicted the computer anxiety among preservice teachers involved in the study. The observed ($F_{(6, 307)}=15.67$, $p<.001$) is a reliable evidence that the combination of the dimensions of attitude toward computer, computer self-efficacy and gender in the prediction of preservice teachers' computer anxiety from all indications did not occur by chance with 76.6% of the variance in computer anxiety unexplained by the current data. Thus, there might be other independent variables which may require further investigations about their contribution to the prediction of preservice teachers' computer anxiety and the degree of prediction jointly made by the six independent variables of this study could be substantive enough to assert that preservice teachers' computer anxiety is predictable by a combination of the dimensions of attitude toward computer, computer self-efficacy and gender. Thus, the strength of the predictive power of the combined independent variables (perceived usefulness, affective component, perceived control, behavioural intention, computer self-efficacy 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 preservice teachers' computer anxiety. According to the standardized coefficients the regression model is as follows: Computer anxiety$_{predicted}$ = 8.77 + 0.239 affective component + 0.164 perceived usefulness component + 0.045 behavioural intention component + 0.167 perceived control component +0.213 computer self-efficacy - 0.051 gender.

On the relative contribution of each of the independent variables to the explanation of variance in preservice teachers' computer anxiety, the present study revealed that only four (affective component, perceived control component, perceived usefulness component and computer self-efficacy) out of the six independent variables made statistically significant contribution to the variance in preservice teachers' computer anxiety. Affective component of attitudes toward computer scores accounted for 11.5% of the variance in preservice mathematics teachers' computer anxiety. This was followed by computer self-efficacy which alone accounted for 4.5% of the variance in preservice mathematics teachers' computer anxiety. This agreed with the finding of Embi (2007) who found that computer self-efficacy alone explained 36.1% of the variance in computer anxiety. Perceived control component alone accounted for 4.2% of the variance in preservice mathematics teachers' computer anxiety and this was followed by perceived usefulness component which alone accounted for 2.8% of the variance in preservice mathematics teachers' computer anxiety. Behavioural intention component and gender did not contribute meaningfully to the prediction of preservice teachers' computer anxiety. That attitudes towards computer explained a variance of computer anxiety in the present study coincided with the findings of Korobili, Togia and Malliari (2010).

5. Conclusion

Students will be less efficacious in using technology if they are confronted with threats which relate to technology anxiety. Attitudes toward computer and computer self-efficacy are strong correlating factors with computer anxiety. More so, students' gender is a perennial issue that needs more investigation since there abound conflicting results regarding gender effect in technology usage. As change agents in the educational institutions, teachers at all levels are significant drivers whose roles are crucial in technology integration in the classrooms. Thus, it is vital for teachers to hold positive attitudes towards computer since attitude is connected to usage and intention to use technology in schools. Attitude towards technology whether positive and negative influence how teachers react to technology in a learning environment and this in turn influences the way students respond to technology in the classrooms (Teo, 2006) and current and future technology usage (Teo, 2008a). In

Nigeria the level of technology in schools is growing and the degree to which it is put to meaningful use is a function of teachers having positive attitude towards it (Huang & Liaw, 2005). In fact there is the need for preservice mathematics teachers to engage in the usage of computer for instructional purpose and experience success in it in a conducive and non-threatening environment with a view to making them gain competence and efficacy in using technologies for teaching and learning when they become teachers in secondary schools.

While attitudes towards computer have been studied in relation to the *Technology Acceptance Model* (TAM) (Teo, Lee & Chai, 2008) evidence suggests that the perceived importance of computers, enjoyment, and anxiety are associated significantly with computer attitudes (Teo, 2007). Computer anxiety is a strong factor that has not generated heated research in Nigeria (Arigbabu, 2009) in which only few studies have assessed computer anxiety across more than one country (Allwood & Wang, 1990; Collis & Williams, 1987; Marcoulides & Wang, 1990; Rosen & Weil, 1995). There has been a lack of studies to prove the relationship of computer attitudes and computer self-efficacy to computer anxiety among preservice teachers in Nigeria. More research needs to be conducted in this area. An understanding of this will help educators to develop techniques that address the unique needs of different groups of computer users (Teo, 2008a).

6. Recommendation

With respect to the findings of previous studies, an individual computer anxiety may have profound influence on his/her learning effectiveness with computer technology. Thus, educational institutions across Nigeria should pay more attention to reducing this anxiety so that positive e-learning experience can be developed. By successfully reducing computer anxiety among computer users preservice mathematics teachers inclusive, will engender countless number of benefit to them. Preservice mathematics teachers will not only gain efficacy in computer usage but will also hold positive computer attitudes.

Studies on the relation between computer attitudes, computer self-efficacy and computer anxiety should not be limited to students and teachers only, other stakeholders in education such as parents and community should be assessed in order to document assessment of technology in education. This is a fertile area of research that could promote the rich discussion of attitudes toward computer use in schools. A cutting edge research should be conducted to explore effective training strategies to combat computer anxiety, increase computer self-efficacy and promote positive computer attitudes among the different categories of computer technology users. Even though there were significant positive correlations among self-efficacy, anxiety and attitudes, attitudes explained more variance of the anxiety than self-efficacy, and no inference can be made about their causal relationship. Thus, future study is needed to investigate the causal relationship among attitudes towards computer, computer self-efficacy and computer anxiety.

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