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Examining psychometric characteristics of the computer anxiety scale

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ABSTRACT

The psychometric characteristics of the 20-item computer anxiety scale (CAS) were examined in a Nigerian sample of 181 preservice teachers (62 men and 119 women). Results indicated a two-factor solution, consistent with those from other studies. The two factors accounted for 41.6% of the total variance in the solution. The internal consistency reliability for the entire scale (.89) was considered conceptually meaningful. This result suggests that computer anxiety construct, as measured by CAS, appears to be culturally and contextually invariant.

1. Introduction

The advent of computer and information technology in almost all spheres of human endeavour; as could be observed was accompanied with mixed reactions. Particularly, in the field of education, stakeholders are diametrically on both ends of the divide concerning its acceptance or otherwise. While some hold the view that computer has come to be an indispensable ally in education, others, do not see any need for its introduction and thus continue to resist this innovation in education. Indeed, Todman (2000) has reported that very many people have negative opinions or exhibit some level of anxiety towards the use of computer. Attitude towards computer by students and teachers as well as computer competencies required by them have been addressed by various researchers For example, (Myers & Halpin, 2002). Also Khine (2001) found a significant relationship between computer attitude and its use among preservice teachers. This finding was corroborated by Yuen and Ma (2002) who, using the Chinese computer attitude scale for teachers (CAST), found affective attitudes, general usefulness, behavioural control, and pedagogical use to be significant in determining the use of ICT. Kumar and Kumar (2003) reported that most teachers believe that the amount of computer experience has a positive effect on attitude towards computers. Jackson, Ervin, Gardner, and Schmitt (2001) indicated that female users, compared with males, are more inclined to hold negative reactions to computers and such differences may have resulted in the different ways of using computers.

Some other studies on computer anxiety and attitudes also included the gender dimension. For instance, Margolis and Fisher (2002) and Markauskaite (2006) found no significant relationship for age and gender, and computer attitudes. This finding negates some earlier ones which suggested significant differences in computer attitudes by gender. For example, Houtz and Gupta (2001) found that males and female rated themselves on their ability to use the computer in significantly different ways. It has also been reported, that males have more experience and make more use of computers (Balka & Smith, 2000; Brosnan & Lee, 1998).

It is usual to consider the issue of gender in the context of other user variables such as self efficacy, computer anxiety, and computer experience. For example, Chua, Chen, and Wong (1999) and Coffin and Mackintyre (2000) in their meta-analyses on the relationships between computer anxiety, computer attitudes, computer self efficacy and computer experience stated that most findings usually reinforce the gender effects and suggested that greater levels of computer experience are associated with lower computer experience and more positive computer attitudes. Females usually also have more negative attitudes towards computers (Durndell & Thompson, 1997) and greater computer anxiety (McIlroy, Bunting, Tierney, & Gordon, 2001) than males. Research on computer self efficacy in general also revealed that males on average tend to acquire computer self efficacy faster than females (Todman, 2000). To a large part, North and Noyes (2002) felt that increased use of computers for teaching and learning in schools has worked against the development of gender differences as reported in previous research, a situation consistent with the use of computers in the Singapore schools (Teo, 2006).

However, despite the various works already done in the area of computer anxiety, further research; particularly, across cultures is still very scanty.

Computer anxiety, termed computer-phobia by Cantrell (1982), refers to the fear or apprehension experienced by individuals in the

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course or at the thought of using computers (Chua, Chen, & Wong, 1999). Kanfer and Heggestad (1997), have reported that performance of participants with higher computer anxiety might be poorer than those with little or no computer anxiety. This has been premised on the finding that Computer anxiety is characterized as an affective response, an emotional fear of potential negative outcomes which is capable of detracting cognitive resources from task performance. Arigbabu (2006a) undertook a study of the computer anxiety of some Nigerian preservice teachers. Results of the study indicated that computer anxiety construct was invariant with respect to gender, year of study, and group (science/non-science) students belonged to. In addition, high prevalence of computer anxiety in the Nigerian sample, relative to those of Germany and America was found. In a related study Arigbabu (2006b) found no statistically significant difference in the computer anxiety exhibited by preservice teachers on a 3-year Nigeria Certificate in Education (NCE) teacher education programme and those on a 4-year Bachelor of Education degree programme.

Like mathematics anxiety, various scales have been developed to measure this construct. Some of these are Oetting's (1983) computer anxiety scale (COMPAS); Maurer's (1983) computer anxiety index (CAI); Loyd and Gressard's (1984) computer attitude scale; Marcoulides' (1985) computer anxiety scale, and Rosen, Sears, and Weil's (1987) computer anxiety rating scale.

In the last two decades, psychometric properties of these instruments have been examined and re-examined by various researchers (e.g. Campbell & Dobson, 1987; Francis & Evans, 1995; Kluever, Lam, Hoffman, Green, & Swearingen, 1994). The results of such studies have been mixed. Advancements in computer, information and communication technology in recent years have thus necessitated re-examination of the computer anxiety construct. The present study is a response along this direction. All the instruments mentioned were developed in more advanced and developed environments, hence another motivation, was to examine whether the psychometric properties of the CAS (Marcoulides, 1985, 1989; Marcoulides, Rosen, & Sears, 1985) would be preserved in another relatively less advanced and less developed context. The population of focus here are preservice teachers, tomorrow's education leaders. Most studies on computer anxiety have not considered this group. Assessing the level of computer anxiety held by teachers, and indeed, preservice teachers, is no doubt of great value to educationists Teo (2008).

2. Methods

2.1. Participants

Participants were 181 preservice teachers in a college of education in south west Nigeria. This was made up of 40 (22%) in the final year and 128 (71%) in the second year of their 3 year programme (though 22 (7%) did not indicate their year of study, they were certainly not in the first year as administration was during class work in each of the classes). There were 62 (34%) men and 119 (66%) women with ages ranging between 16 and 40 years ($M = 22.5$, $SD = 2.9$). All of them took the mandatory introductory computer course in the second semester of their first year.

2.2. Instrument and procedure

The computer anxiety scale (CAS) (Marcoulides, 1985, 1989; Marcoulides et al., 1985) was administered to participants during school hours, towards the end of the first semester. They were informed about how they had the option not to participate if they so wished although their unsolicited responses would be highly appreciated. In the CAS questionnaire, each item was rated on a 5-point Likert-type scale anchored by 1: not at all and 5: very much. Background information sheet was also included, for respondents to indicate gender, age, matriculation number, and subject combination (teaching subjects). Prior to the administration of questionnaire, detailed explanation about the instrument was given. They were also assured that there was no right or wrong answers and that all information would be held in strict confidence.

3. Results

The reliability and validity of the CAS questionnaire was first established. To identify the dimensions of the questionnaire, principal components factor analysis was computed with varimax rotation. Kaiser's (1960) criterion (eigenvalue greater than 1.0 rule) was used to determine the initial number of factors to be retained for rotation. This was used in conjunction with an analysis of the scree plot and the percentage of variance accounted for by the factor solution. A five-factor solution was initially obtained. This was considered inappropriate as one of the components had just one item. A four-factor solution computed was also abandoned as one of the factors with only three items had very low internal consistency reliability (.54). For the three-factor solution, corresponding eigenvalues for the three components were 6.8, 1.5, and 1.3 which accounted for 34.1%, 7.5%, and 6.3% of the total variance (respectively). This solution was also jettisoned as the third factor with three items had low internal consistency reliability (.66). The other two components, however, had coefficient alpha values of .86 and .73. An examination of the scree plot of eigenvalues (Fig. 1) gave an indication suggestive of a two-factor solution.

The two-factor solution was thus computed and this was found meaningful as the internal consistency values of .88 and .70 were obtained for components 1 and 2, respectively. The two factors accounted for 41.6% of the total variance in the solution. The internal consistency reliability for the entire scale (.89) was considered conceptually meaningful (Curtis & Singh, 1997) as it satisfies criteria for the determination of the number of components to retain. It is remarkable that a number of earlier studies (Marcoulides, 1985, 1989, 1990a, 1990b, 1991) identified CAS as comprising of two factors, namely, a general computer anxiety factor and an equipment factor. The former comprised items relating to anxiety resulting from direct experiences with computer technology through the actual use while the later con-

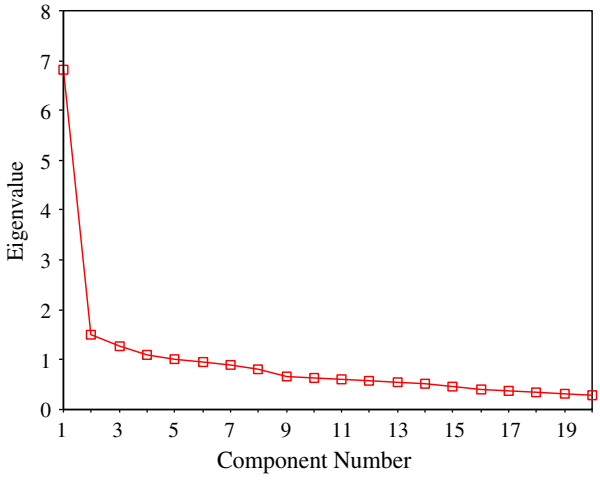

Fig. 1. Scree plot showing number of components and eigenvalues of the correlation matrix.