DEVELOPMENT OF A TOOL TO MEASURE COMPUTER ANXIETY OF PRE-SERVICE TEACHERS

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Abstract

This paper describes the process of the development of an instrument to measure computer Anxiety of pre-service teachers.Computer anxiety as the psychological state of individuals who have negative reactions towards using computers. But it is observed that there is no tool with desired psychometric properties to measure the computer Anxiety of pre-service teachers. The scale has high validity and reliability indices indicating that the tool can be used to measure the computer anxiety of the pre-service teachers.

INTRODUCTION

The computer technologies, we are increasingly encountering these technologies in every field of life. The fact that the computer technology is so much interwoven with the daily life makes it necessary to investigate certain psychological attitudes of those working with computers. One of these psychological attitudes is computer anxiety. Howard and Smith (1986) define the computer anxiety as "the tendency of a person to experience a level of uneasiness over his or her impending use of a computer". According to another definition, computer anxiety is a behavior of avoiding interaction with the information processors (Weinberg, 1983). According to Cambre and Cook (1985), computer anxiety is a result of forcing to social change emerging from the rapid nature of the new technology.Oetting (1983) stated that computer anxiety is a concept-specific anxiety because it is a feeling that is associated with a specific situation, in this case when a person interacts with computers. He elaborated by saying that computer anxiety is "the

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anxiety that people feel they will experience when they are interacting with computers--the anxiety associated with the concept of computers" (p. 1). Herdman (1983) defined computer anxiety as emotional fear, apprehension, and phobia felt by individuals towards interactions with computers or when they think about using computers. Cambre and Cook (1985) stated that computer anxiety is a form of state anxiety, and it was brought on in part by the rapidly changing nature of new technology and the subsequent pressure for social change in modern time. Heinssen, Glass, and Knight (1987) stated that computer anxiety refers to negative emotions and cognitions evoked in actual or imaginary interactions with computer-based technology, and it affects the utilization of computer-based technology and performance on tasks that involve the use of computers. Stone, Arunachalam, and Chandler (1996) concluded that computer anxiety is a psychological construct that is related to, but distinct from, computer self-efficacy. Rosen and Weil (1990, 1995) described computer anxiety as "technophobia" and used the term "cyberphobia" to describe individuals who are frightened by the use of computers and technology. Computer anxiety has also been classified as a complex psychological construct that cannot be fully described from a single perspective (Chua, Chen, & Wong, 1999). Chua et al. simply generalized the definition of computer anxiety as "a kind of state anxiety, which can be changed and measured along multiple dimensions" (p. 611). Torkzadeh and Angulo (1992) stated that computer anxiety can be changed with appropriate training. Beckers, Wicherts, and Schmidt (2006) concluded that computer anxiety appears to harbor components of trait anxiety that will negatively influence the success of treatments that are solely focused on teaching computer users the complexities of various applications.

Measuring Computer Anxiety

There are many researchers who have developed scales to measure computer anxiety. Studies have focused on the various factors involved in this phenomenon such as gender, computer experience, parental and peer influences, self-efficacy.

Maurer and Simonson (1984) designed the Computer Anxiety Index (CAIN) that uses a 26-item Likert-like scale that measuresparticipants' anxiety toward computers by examining avoidance, negative attitudes, anxiety, and computer comfort.

Rosen, Sears, and Weil (1987) introduced Computer Anxiety Rating Scales (CARS) to measure a variety of aspects and features of technological anxiety. These include "anxiety aboutthe machines themselves, their role in society, computer programming, computer use, and consumeruses of technology, problems with computers and technology and technology in the media" (Rosen et al. 1990, p. 9). This scale is different from the one developed by Heinssen et al. (1987)but has the same name.

The Computer Anxiety Rating Scale (CARS) developed by Heinssen et al. (1987) has been cited in many studies. This scale, a self-report inventory designed to assess individuals' levels of computer anxiety with a 19-item questionnaire, is based on a five-point Likert scale (1=strongly disagree to 5=strongly agree). The instrument was administered to 270 introductory psychology students in a university. Participants responded to items such as technical capability, appeal of learning about and using computers, being controlled by computers, learning computer skills, and traits to overcome anxiety. The instrument could also be used to identify individuals who would benefit from counseling to overcome their anxiety of using computers. The authors also included information on the relationship between computer anxiety and math and test anxiety, the amount of computer experience, cognitive styles, mechanical interests, and SAT scores. The authors reported high internal consistency of the entire instrument with Cronbach alpha = .87, and that it was reliable ($r = .70$, $p < .0001$) and stable ($t = -1.06$, $p < .30$). This was corroborated by both Coakes and Steed (2003) and Pallant (2001) who have written that alpha values above .70 are sufficient to demonstrate reliability.

Meier (1988) introduced a Computer Aversion Scale that consists of 31 items, using a true-false scale to produce four scores for computers (a) efficacy expectations, (b) outcome expectations, (c) reinforcement expectations, and (d) total score of the cumulative effects of reinforcement, outcome, and efficacy expectations. This scale was designed to be used with mental health clients and workers, high school age, and older.

Harrison and Rainer (1992) used the CARS developed by Heinssen et al. (1987) administered to 693 university personnel perceptions regarding specific computer-related knowledge and skills. The data were analyzed using principal components factor analysis as the extraction technique

and orthogonal rotation to examine the construct validity of the 19-item CARS. The authors' study produced two factors (a) high anxiety toward computer use, and (b) confidence, enthusiasm and/or anticipation of computer use. The authors reported Cronbach alpha coefficients concerning the internal consistency of the sub-scales of .84 and .85 respectively. There was, however, little agreement as to the specific factors to measure computer anxiety among respondents.

Computer Anxiety Scale by Embi (2007) who slightly modified the version of the Computer Anxiety Scale (CARS) developed by Hienssen Glass and Knight (1987). In the pilot test, questionnaire was distributed among 20 faculty members at UITM in Malaysia. The overall reliability coefficient of the scale was .74. The instrument with 18 statements of which eight were positively and ten were negatively worded are based on a 4 point Likert type scale designed as: strongly disagree (1), moderately disagree (2), moderately agree (3) and strongly agree (4). The direction of item scores is reversed for negatively worded items, so that a response of strongly agree is given a value of 1, agree value of 2, and so on. All positively worded CARS response items (8 items) were reversed prior to analysis so that the higher scores on all items indicated a higher level of anxiety. The overall computer anxiety score varies from 18 to 72, showing the lowest level of computer anxiety to the highest level of computer anxiety

Preparation of items

In the development of Computer Anxiety scale, the first step involved was careful identification and selection of items relating to Computer Anxiety scale. For this purpose, an exhaustive review of literature Computer Anxiety scale was made. The investigator scanned several scales developed by foreign authors and selected the statements were written under the three dimension of the variable namely, General Computer Anxiety, Computer usage Anxiety and Internet Anxiety .The draft tool consisting of 27 statements.. In order to ensure the relevancy and to remove the ambiguity in the wordings, the prepared statements were discussed with the supervisor. After proper editing and scrutiny, the final form of the draft scale was prepared.

TABLE:-1.1

Summary of the total dimensions and number of statements in each dimension of the tool

Dimensions	Item No	Total number of items
1. General Computer Anxiety	1-15	15
2. Computer usage Anxiety	16-19	4
3. Internet Anxiety	20-27	8

The final form of the draft scale of 27 items was printed with five points of answers against each item.

Mode of Responding

The scale consisted of 27 statements. For each statement, there were five answers namely 'Strongly agree', 'Agree', 'Undecided', 'Disagree', 'Strongly disagree'. The response to each statement was made by entering a tick mark (√) for the appropriate one from the five alternatives provided in the separate response sheet.

Scoring procedure

The scoring was done with the help of the key given by the investigator. The scale consisted of both positive and negative statements. The responses ranged from strongly agree to strongly disagree. For getting the scores, each answered item was checked by using the following criteria.

TABLE 1.2

The Scoring key is as shown below

Responses	Score for Positive Items	Score for Negative Items
Strongly Agree	5 Points	1 Points
Agree	4 Points	2 Points
Undecided	3 Points	3 Points
Disagree	2 Points	4 Points
Strongly Disagree	1 Points	5 Points

The summated scores of all the 27 statements provide the computer anxiety score of the subject. Thus, the maximum possible score of all the 27 statements would be 135 and minimum possible score would be 27.

Tryout of the scale

The draft scale consisting of 27 statements was tried out on a sample of 89 Pre-service teachers, selected from the different locales of Rohtak district of Haryana State. The response sheets were collected and scored for each individual response separately.

Item analysis

The statements for the final analysis were selected on the basis of the discriminating power of each item. The discriminating power of each item was determined by calculating the t-value of the item. For this, the procedure suggested by Kelly (1939) was followed. The responses were scored using the scoring procedure mentioned earlier. The scores obtained for each item and the total score for each individual were marked separately. The response sheets were arranged according to the descending order of the scores. Then, the top 27% and the bottom 27% respondents were taken which represented the high and low groups. A frequency table under each group was prepared for each item, to represent the number of subjects marking the five responses namely, 'Strongly agree', 'Agree', 'Undecided', 'Disagree', 'Strongly disagree' The t-value was calculated .The obtained t-value for all items are given in table 1.3.

TABLE 1.3

The obtained t-value for each item Item No.

Item No.	t-value	Item No	t-value	Item No	t-value
CAS1	16.249	CAS 12	12.198	CAS 23	29.824
CAS2	31.700	CAS 13	20.228	CAS 24	12.040
CAS3	35.031	CAS 14	21.358	CAS 25	15.903
CAS4	13.829	CAS 15	20.843	CAS 26	16.239
CAS5	16.367	CAS 16	15.158	CAS 27	13.997
CAS6	11.379	CAS 17	18.731		
CAS7	13.703	CAS 18	16.417		

CAS8	32.051	CAS1 9	13.815		
CAS9	28.923	CAS 20	11.977		
CAS10	31.021	CAS21	12.869		
CAS11	12.249	CAS22	16.213		

The‘t’ value of the Computer Anxiety Scale (CAS) ranged from 11.397 to 35.703. All the items were significant at 0.01 levels. Hence all 27 items were selected for final scale.

Validity of the tool

The present tool ensures most of the essential validities. Content validity is based on the extent to which a measurement reflects the specific intended domain of content. The items in the tool were selected after the judgment of subject specialists. Thus, the tool possesses content validity. Construct validity for the tool was also established. Construct validity seeks agreement between a theoretical concept and a specific measuring device or procedure. To understand whether a piece of research has construct validity, three steps should be followed. First, the theoretical relationships must be specified. Second, the empirical relationships between the measures of the concepts must be examined. Third, the empirical evidence must be interpreted in terms of how it clarifies the construct validity of the particular measure being tested. In the present study, the method followed in the Construction of the scale, criteria considered for preparing the statements, model of selection of dimensions for the scale, all these were done as per theoretical bases. Hence, the investigator assumes that the scale has construct validity. Face validity is concerned with how a measure or procedure appears. Face validity does not depend on established theories for support. As the tool was distributed to some computer super specialists. the judgment of which was positive, the tool ensured face validity. Criterion related validity, also referred to as instrumental validity, is used to demonstrate the accuracy of a measure or procedure by comparing it with another measure or procedure, which has been demonstrated to be valid. The investigator also established criterion related validity of the tool by correlating the scores obtained by sub dimension of the scale.

Table.1.4

Coefficient of correlation of total scores with scores on three dimensions

Dimensions	(1) General Computer Anxiety	(2)omputerusage Anxiety	(3) Internet Anxiety
WHOLE CAS	0.786384	0.719835	0.608413

The correlation ranged from 0.608413 to 0.786384 and all the correlation are significant at .01 level. These high significant correlations demonstrate that the sub dimensions have high validly.

Reliability of the tool

The investigator established the reliability of the tool by split half method. The split-half design in effect creates two comparable test administrations. The items in the test are split into two equal halves that are equivalent in content and difficulty. In the present study, the investigator has done splitting among odd and even numbered items of 47 individual scores. This assumes that the assessment is homogenous in content. Once the test is split, reliability is estimated as the correlation of two separate tests with an adjustment for the test length. The investigator estimated the reliability of the tool by correlating the two half scores using Spearman Brown Prophesy Split-Half Coefficient formula. The value of r, i.e., the reliability coefficient between the two scores was found to be 0.754 (N=47). Cronbach's Alpha value is 0.818.

References

- Cambre, M. A., & Cook, D. L. (1985). Computer anxiety: definition, measurement and correlates. Journal of Educational Computing Research, 1(1), 37-54.
- Chua, S. L., Chen, D.T., & Wong, A. F. L. (1999). Computer anxiety and its correlates: A metaanalysis. Computers in Human Behavior, 15(5), 609-623.
- Gardner. E., Render, B., Ruth, S., & Ross, J. (1985). Human-oriented implementation cures "cyberphobia". Data Management, 11, 29-32, 46.
- Heinssen, R.K., Glass, C.R., & Knight, L.A. (1987). Assessing computer anxiety: Development and validation of the Computer Anxiety Rating Scale. Computers in Human Behavior, 3, 49-59.

- Howard, G. S., & Smith, R. D. (1986). Computer anxiety in management: Myth or reality? Communication of theACM, 29(7), 611-615.
- Hardman, P.C.(1983).High tech anxiety. Management Focus, 30(3), 29-31.
- Heinssen, R. K., Glass, C. R., & Knight, L. A. (1987). Assessing computer anxiety: Development and validation of the computer anxiety rating scale. Computers in Human Behavior, 3, 49-59
- HarrisonA.W. & Rainer, K.R. (1992). The influence of individual differences on skill in end-user computing.Journal of Management Information System, 9(1), 93-111
- Igbaria, M., &Parasuraman, S. (1989). A path analytic study of individual characteristics, computer anxiety, and attitudes towards microcomputers. Journal of Management 15(3).373-388.
- Marcoulides,G.A. & Wang X.B.(1990). A Cross-cultural comparasion of computer anxiety in college students. Journal of Educational Computing Research .6 (3)252-263.
- Maurer, M. W., & Simonson, M. R. (1984). Development and validation of a measure of computer anxiety. Paper presented at the Association for Educational Communicationsand Technology, Dallas, TX.
- Meier,S. T. (1988). Predicting individual differences in performance on computer-administeredtests and task: Development of the computer aversion scale. Computers in HumanBehavior, 4(3), 175-187.
- McInerney, V., McInerney, D. M., & Sinclair, K. E. (1994). Student teachers, computer anxiety and computer experience. Journal of Educational Computing Research, 11(1), 27-50.
- Mahar, D., Henderson, R., & Deane, F. (1997). The effects of computer anxiety, state anxiety, and Computer experience on user's performance of computer based task.Personality andIndividual Differences, 22(5), 683-692
- Oetting, E. R. (1983). Manual: Oetting's computer anxiety scale (COMPAS). Ft. Collins, Colorado: Tri-Ethnic Center for Prevention Research, Colorado State University.
- Rosen, L. D., & Weil, M. M. (1990). Computers, classroom instruction and the computerphobicuniversity student. Collegiate Microcomputer, 8(4), 257-283.
- Rosen, L. D., Sears, D. C., & Weil, M. M. (1987). Computerphobia. Behavior ResearchMethods, Instruments and Computers, 19(2), 167-179.

- Rosen, L. D., & Weil, M. M. (1995). Computer availability, computer experience and technophobia among public school teachers. Computers in Human Behavior, 11(1) 9-31.
- RoslaniEmbi (2007).Computer Anxiety and Computer Self-Efficacy among Accounting Educators At UniversityTeknologi Mara (UiTM), MALAYSIA.
- Venkatesh, V., Morris, M. G., & Ackerman, P. L. (2000). A longitudinal field investigation ofgender differences in individual. Organizational Behavior and Human DecisionProcesses, 83(1), 33-60.