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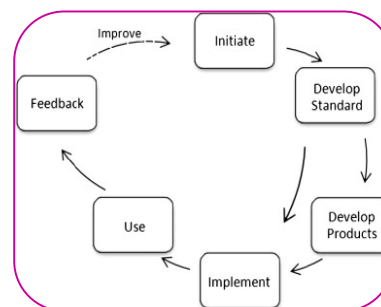## CONSTRUCTION AND STANDARDISATION OF COMPUTER ANXIETY SCALE

**Dr. Ram Mehar [1] and Dr. Gagandeep Kaur [2]**
[1]Assistant Professor, Dept. of Education, USOL Panjab University, Chandigarh.
[2] Assistant Professor, Dept. of Education, GNDU, Amritsar.

**ABSTRACT**

    *This paper highlights the process of construction and standardization of Computer Anxiety Scale for adolescents. Computer anxiety is a concept-specific anxiety as it is a feeling associated with a specific situation, in this case when a person interacts with computers. The scale initially consisted of 47 items after review and evaluation by subject experts, which were reduced to 35 in the first try out and then finally to 25 items in the final draft after the item analysis. The test-retest reliability of the test was computed to be 0 .81. The validity coefficient's (the correlation coefficient's obtained between total scores on the present scale and CARS) was 0.77 and the scale was found to be valid.*

**KEY WORDS:** *Computer Anxiety, Scale, Construction, Standardisation.*

## INTRODUCTION:

    Computer anxiety is a concept-specific anxiety as it is a feeling associated with a specific situation, in this case when a person interacts with computers. Computer anxiety is " the anxiety that people feel they will experience when they are interacting with computers- the anxiety associated with the concept of computers" (Oetting, 1983).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 (1932) that measures participants' 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 about the machines themselves, their role in society, computer programming, computer use, consumer uses of technology, problems with computers and technology in the media" (Rosen and Weil, 1990).

    The Computer Anxiety Rating Scale (CARS) developed by Heinssen, Glass and Knight (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 counselling to overcome their anxiety of

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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 atrue-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.

To measure computer anxiety, Harrison and Rainer (1992) used theComputer Anxiety Rating Scale (CARS) developed by Heinssen, Glass and Knight (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-items Computer Anxiety Rating Scale. 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 0.84 and 0.85 respectively. There was, however, little agreement as to the specific factors to measure computer anxiety among respondents.

The scanning of the already developed above mentioned tools revealed that most of the scales were constructed in foreign countries and developed to measure adult's perceptions, which could not be scientifically used in Indian educational settings and to measure computer anxiety of students. This need led the researcher to develop a tool to measure computer anxiety of students. The process of construction of computer anxiety scale was carried out in three phases such as (i) planning phase (ii) construction phase (iii) standardization phase. The description of these phases is given below:

(i) *Planning Phase:* The researcher reviewed the literature from various sources such as journals, newspapers, books, official sources and web sources. The present scale was designed to measure the computer anxiety of students in the light of the operational definition of computer anxiety, which is as follows: Emotional fear, apprehension and phobia felt by individuals towards interactions with computers or when they think about working with a computer.

(ii) *Construction Phase:*On the basis of available literature on computer anxiety, a number of statements were framed with the help of experienced colleagues, school principals, computer experts and students.The construction phase of the computer anxiety scale passed three stages such as (i) First draft of computer anxiety scale (ii)Second draft of computer anxiety scale (iii) Final draft of computer anxiety scale.

## FIRST DRAFT OF THE COMPUTER ANXIETY SCALE

For the first draft, 47 items were tentatively framed in the form of statements.The first draft of 47 items was shown to experts to examine the content, repetitiveness, and ambiguity of the items as the editing process is very important in the Likert technique of scale construction. Ten experts with long standing experience in the field of teaching at school, college, university levels were approached for this purpose. The distribution of positive and negative items for the first draft has been given in table 1.

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**Table 1: Distribution of positive and negative items for the first draft**

| Statements | Item no. | Total |
|---|---|---|
| **Positive items (+)** | 1,2,4,6,7, 9, 10,11,12, 13,15, 17, 18, 19, 21, 22, 25,26,29,35 | 20 |
| **Negative items (-)** | 3, 5, 8,14, 16, 20,23,24, 27, 28, 30, 31, 32,33,34,36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47 | 27 |
| **Total** | | 47 |

- *First Try-out and Evaluation* - The experts were personally requested to go in for serious reflection over every statement and to respond critically and objectively with their comments and observations. The investigator along with her supervisor devoted several sittings, to consider the judgments of the said experts on the statements relating to computer anxiety. Keeping in view their judgment and comments, 12 items were discarded and a few were reframed and reworded. In this way, a pool of 35 statements was finalized for the second draft of the scale. On the basis of opinions of judges, 12 items were dropped and 7 items were modified as shown in table 2.

**Table 2: Description of items dropped or modified**

| S.No. | Item no. | Remarks |
|---|---|---|
| 1 | 3, 7, 9, 10, 16, 20, 23, 27, 28, 32, 37, 46 | Dropped |
| 2 | 10, 12, 14, 17, 18, 30, 34 | Modified |

Table 2 shows that upon evaluation by the judges 12 items were dropped, while 7 were modified in light of the suggestions. So, the second draft consisted of 35 items. The distribution of positive and negative items for the second draft has been given in table 3.

**Table 3: Distribution of positive and negative items for the second draft**

| Statements | Item no. | Total |
|---|---|---|
| **Positive items (+)** | 1,2,3,4,5,6,7,10,11,12,15,16,24,26,28,29,31 | 17 |
| **Negative items (-)** | 8,9,13,14,17,18,19,20,21,22,23,25,27,30, 32,33,34,35 | 18 |
| **Total** | | 35 |

**SECOND DRAFT OF COMPUTER ANXIETY SCALE**

The second draft of the computer anxiety scale consisted of those items which were accepted as such and which were modified or revised taking into consideration the opinion given by the experts.

- *Second Try-Out and Evaluation:* The second draft of computer anxiety scale consisting 35 items was administered to a sample of 50 students of class IX of two schools for item validity. The details of the sample structure of try-out for second draft of the computer anxiety scale have been given in table 4.

**Table 4: Selection of students for second try-out**

| S.No | Name of the School | Total |
|---|---|---|
| 1 | Khalsa College Senior Secondary Girls School, Amritsar. | 25 |
| 2 | Shri Ram Ashram Public School, Amritsar. | 25 |
| **Total** | | 50 |

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      The table 4 shows that the responses of the subjects were scored as per allotted weight age. The weighted score for each item and for each subject were summated. On the basis of total scores, 27% subjects with high scores i.e. high group and 27% with low scores i.e. low group were identified. Their scored responses in terms of weighted scores for each item were worked out. Item analysis was carried out by employing the t-test for 35 items for high and low group. The t ratio was computed for the higher and lower groups to find discriminating power of each item. Thus, the significance of difference between the means of scores of high and low group was worked out to find the discriminating power of each item i.e. how well each statement could distinguish on the basis of the value of t-ratio, between students with high and low computer anxiety. Items with t-value positive and significant at 0.05 level of confidence were selected for the scale. The t-ratio for 10 items was not significant even at 0.05 level of significance and rest of the items were significant at 0.01 level of significance. The t-ratios of 35 items have been placed in table 5.

### Table 5: t-ratio of the second draft of computer anxiety scale

| Item No. | t-ratio | Item No. | t-ratio |
|---|---|---|---|
| 1 | 0.00 | 19 | 0.38 |
| 2 | 0.65 | 20 | 1.74 |
| 3 | 2.86** | 21 | 4.59** |
| 4 | 2.87** | 22 | 2.72** |
| 5 | 1.33 | 23 | 4.29** |
| 6 | 3.96** | 24 | 1.33 |
| 7 | 0.21 | 25 | 1.53 |
| 8 | 4.66** | 26 | 3.11** |
| 9 | 3.93** | 27 | 3.23** |
| 10 | 4.26** | 28 | 4.08** |
| 11 | 4.19** | 29 | 2.87** |
| 12 | 3.59** | 30 | 3.06** |
| 13 | 4.39** | 31 | 2.75** |
| 14 | 4.09** | 32 | 4.71** |
| 15 | 3.56** | 33 | 1.89 |
| 16 | 2.79** | 34 | 2.92** |
| 17 | 2.66* | 35 | 3.66** |
| 18 | 0.82 | | |

*Significant at 0.05 level**Significant at 0.01 level
 (Critical Value 2.01 at 0.05 and 2.68 at 0.01 level, df 33)

      Table 5 shows that t-ratio for item number 1, 2, 5, 7, 18, 19, 20, 24, 25 and 33 was not significant even at 0.05 level of significance. Hence, 10 items were dropped and 25 items were retained.

### FINAL DRAFT OF COMPUTER ANXIETY SCALE
      The final draft of computer anxiety scale consisted of 25 items. The distribution of positive and negative items in the final draft of computer anxiety scale has been given in table 6.

### Table 6: Distribution of positive and negative items for the final draft

| Statements | Item no. | Total |
|---|---|---|
| Positive items | 1,2,3,5,6,8,10,13,16,19,21,24 | 12 |
| Negative items | 4,7,9,11,12,14,15,17,18,20,21,23,25 | 13 |

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|---|---|
| **Total** | 25 |

## SCORING

Each item has a response option on Likert's five points continuum viz, Strongly Disagree, Disagree, Undecided, Agree and Strongly Agree with respective weights of1,2,3, 4 and 5 for the positive statements and 5, 4, 3, 2 and 1 for the negative statements. The scoring procedure adoptedis presented below in table 7.

### Table 7: Scoring procedure for each item of computer anxiety scale

| Items | Score Assigned | | | | |
|---|---|---|---|---|---|
| | **Strongly Disagree** | **Disagree** | **Undecided** | **Agree** | **Strongly Agree** |
| Positive | 1 | 2 | 3 | 4 | 5 |
| Negative | 5 | 4 | 3 | 2 | 1 |

Table 7 shows that computer anxiety score of the subject is the sum total of item scores of all the statements. The theoretical range of scores on this scale is from 25 to 125. High score on the computer anxiety scale corresponds to high computer anxiety among students and vice-versa.

## RELIABILITY

There are many methods by which the reliability of the test measures can be established**.** Guilford (1954) suggested different methods to determine reliability such as: Alternative forms reliability, Test–retest reliability and Internal consistency reliability or simply internal consistency.

All these methods have a common approach of obtaining the two sets of measures from the same scale and administer to the same sample for the purpose of finding co-efficient of reliability. As the scale being heterogeneous and items having been arranged logically, the two halves could not have been identical. Therefore, test-retest reliability criterion was found to be the most suitable for determining the reliability of this scale. For establishing the reliability of the computer anxiety scale, the scale was administered to 100 students of Government Girls Senior Secondary School, Mall Road, Amritsar. To the same students, the same scale was administered after the gap of two weeks for the test-retest reliability. The product moment coefficient of correlation between two sets of scores was found to be 0.81. This was fairly high to testify the soundness of the scale. Cronbach's alpha reliability was also calculated and found to be 0.76. Summary of reliability values has been shown in        table 8.

### Table 8: Reliability coefficient of the computer anxiety scale

| Measure of Reliability | N | Reliability Coefficient |
|---|---|---|
| Test-retest method | 100 | 0.81 |
| Cronbach's alpha | 100 | 0.76 |

Table 8 shows that reliability for the test-retest method was 0.81 andCronbach's alpha reliability was 0.76. Thus, the final draft was considered reliable.

## VALIDITY

The content validity of a scale involves the systematic evaluation of test content to determine whether it covers a representative sample of the behaviour to be measured. The scale was shown to experts for obtaining their verdict on validity and only those items were included on which the experts agreed. Besides this, items of the scale were selected after carefully scrutinizing the definitions of computer anxiety and its various aspects; hence scale has fair degree of content validity.The Computer Anxiety Rating Scale (CARS) developed by Hienssen, Glass and Knight (1987) was used in order to establish concurrent validity.

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The validity coefficient's (the correlation coefficient's obtained between total scores on the present scale and CARS) was 0.77 with sample size 100.

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**Dr. Ram Mehar**
**Assistant Professor, Dept. of Education, USOL Panjab University, Chandigarh.**

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