DEVELOPMENT OF A TOOL TO MEASURE COMPUTER SELF-EFFICACY OF STUDENT TEACHERS

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This article describes the process of the development of an instrument to measure computer self-efficacy of student teachers. Self-efficacy beliefs have repeatedly been reported as a major factor in understanding the frequency and success with which individuals use computers. Computer self-efficacy is also an indicator of computer competency of individuals. But it is observed that there is no tool with desired psychometric properties to measure the computer self-efficacy of student teachers. The scale has high validity and reliability indices indicating that the tool can be used to measure the self-efficacy of the student teachers.

SELF-EFFICACY

The construct of self-efficacy has emerged as a central facet of social cognitive theory. Social cognitive theory posits that behaviour is best understood in terms of "triadic reciprocality" where behaviour, cognition and the environment exist in a reciprocal relationship and thereby influence are determined to a great extent by each other. Bandura (1986) defines self-efficacy as: People's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses. This definition highlights a key aspect of the self-efficacy construct. Specifically, it indicates the importance of distinguishing between component skills and the ability to "organize and execute courses of action." For example, in discussing driving self-efficacy, Bandura (1986) distinguishes between the component skills (steering, braking, signalling) and the behaviours one can accomplish (driving in freeway traffic, navigating twisting mountain roads). Similarly, Compeau & Higgins (1995) distinguishes between the component skills of mathematics (choice of operations and basic arithmetic skills) and mathematics behaviours (solving particular word problems). Thus, computer self-efficacy represents an individual's perceptions of his or her ability to use computers in the accomplishment of a task (i. e., using a software package for data analysis, writing a mail merge letter using a word processor), rather than reflecting simple component skills (i.e., formatting diskettes, booting up a computer, using a specific software feature such as "bolding text" or "changing margins"). The concept of self-efficacy, while representing a unique perception, is similar to a number of other motivational constructs such as effort-performance expectancy (Porter and Lawler, 1968), locus of control, and self-esteem. An important distinction needs to be drawn between self-efficacy, which deals with beliefs about the ability to perform actions, and locus of control theory (Rotter 1966) which is concerned with beliefs about the outcomes of such actions. For example, an individual may hold the belief that their environment is in principle controllable (i.e. exhibiting an internal LOC) but that they personally do not have the skills/ability with which to exert such control (i.e. exhibiting low self-efficacy beliefs). Levels of self-efficacy are thought to be determined by such things as previous experience (success and failure), vicarious experience (observing others successes and failures), verbal persuasion (from peers, colleagues, relatives) and affective state (emotional arousal e.g. anxiety). Self- efficacy levels have been shown to be related to choice of task, motivational level and effort and perseverance with the task. Because self-efficacy is based on self perceptions regarding particular behaviours, the construct is considered to be situation specific or domain sensitive. That is, a person may exhibit high levels of self-efficacy (indicating a high level of confidence) within one domain for example sport, whilst simultaneously exhibiting low levels of self-efficacy within another domain such as academic ability. The suggestion made by Bandura is that the perception that one has the capabilities to perform a task will increase the likelihood that the task will be completed successfully.

Self-efficacy beliefs have been shown to influence behaviour in a wide variety of contexts, e.g. mental and physical health (Bandura, 1986, Schwarzer, 1992), academic achievement (Eachus, 1993, Eachus & Cassidy, 1997) and stock market investment (Eachus, 1994). This paper is primarily concerned with self-efficacy in the context of computer use. Computers are becoming more common-place and what they can offer the user more sophisticated and more complex. The human computer interface is becoming increasingly intuitive, but for the inexperienced users still poses formidable problems. The power of modern computers has the potential to impact on many facets of our everyday lives, but for many people the ability to exert that power is limited by an inability to control that potential. This inability may be real in that the individual genuinely may not have the necessary skills or abilities, or it may simply be a belief which results in incapacity and poor motivation as in the case of self-efficacy expectations.

Self-efficacy beliefs have repeatedly been reported as a major factor in understanding the frequency and success with which individuals use computers. Compeau and Higgins (1995) tested several hypotheses related to a hypothetical linear model of computer use based on social cognitive theory. In their study, individuals with high self-efficacy used computers more, enjoyed using them more and experienced less computer related anxiety. Level of enjoyment and anxiety levels were also identified as significant factors in computer use. The importance of self-efficacy in explaining computer use was also demonstrated by Hill, Smith and Mann (1987) who found that computer self-efficacy beliefs affected whether individuals chose to use computers irrespective of their beliefs about the value of doing so. Many other studies also have shown that Computer Self-efficacy is a factor influencing an individual's computer competency.

Measurement of computer self-efficacy

There are few tools available in the literature to measure the computer self-efficacy. But some of them are developed based on the assumption that computer self-efficacy and computer attitude are same (Eachus & Cassidy 2008), which is not correct. A review of the literature concerning self-efficacy of computers uncovered few existing tools. One utilized a three-item scale to measure computer self-efficacy in a study of the early adoption of computing technologies (Burkhardt and Brass, 1990). This tool requested general perceptions about an individual's ability to effectively use computers in his or her job. Another tool used a four-item scale, revised from a scale used in an earlier study (Hill, Smith & Mann1987). This measure did not, however, appear to be measuring self-efficacy. Three of the items used measured general perceptions about the nature of computing, such as "only a few experts really understand how computers work." Responses to these statements may or may not reflect computer self-efficacy. In another tool by Webster & Martocchio (1992) a five-item scale was developed to measure software efficacy. This measure, while it does seem to capture elements of self- efficacy, also incorporated other concepts, in addition to self-efficacy. For example, one item, used to measure self-efficacy before training, asked the respondents the extent to which they agreed with the statement "I expect to become very proficient at using Word Perfect merging." Responses to this item would also reflect expectations of the quality or content of the training program and might reflect elements of interest (in becoming proficient at WordPerfect merging). The last two measures studied the relationship between computer self-efficacy, computer training methods, and training performance, and both were developed by Gist, Schwoerer & Rosen(1989). The first concerned the general construct, computer self-efficacy. The second focused on a measure specific to using a spreadsheet package. Neither of the measures could be considered task focused. This examination of existing measures of computer self-efficacy indicated the need for additional development work which also possesses required psychometric properties.

STEPS FOLLOWED IN THE DEVELOPMENT OF STUDENT TEACHERS' COMPUTER SELF-EFFICACY SCALE

To develop the computer self-efficacy scale, the scale development guidelines and steps suggested by DeVellis (1991) was followed.

Generating an Item Pool

The investigator thoroughly examined available literature concerning computer self-efficacy. A large number of statements were prepared/collected after careful study of relevant literature. But computer self-efficacy represents an individual's perceptions of his or her ability to use computers in the accomplishment of a task (i. e., using a software package for data analysis, writing a mail merge letter using a word processor), rather than reflecting simple component skills (i.e., formatting diskettes, booting up a computer, using a specific software feature such as "bolding text" or "changing margins")(Compeau & Higgins, 1995) only those items which would reflect an individuals' perceptions of his or her ability to use computers in the accomplishment of a specified task were retained.

Determining the Format of the Scale

At this stage, different scaling option was investigated. For measurement of computer self-efficacy Likert's scale is frequently used. The Likert scale is chosen for its simplicity, wide use in efficacy measurement, higher reliability coefficients with fewer items, and method of summated ratings. It was also found that there is no uniform scaling options being used with usage of five-point agreement /disagreement scale in some researches (Eachus and Cassidy 2008) and ten point numerical scaling with a scale value ranging from 1 to 10. As large number of scale values makes the distinction between neighboring values difficult, it was decided to have five point numerical scaling with the values ranging from 0 to 4. The understanding of each number was considered to be as follows. 4 = Very high confidence; 3 = High confidence, 2 = Low confidence; 1 = Very low confidence; and 0 = No confidence

Content Validity and Review by Experts

Content validity is defined as the extent to which a set of items is relevant and representative of the concerned domain content (Anastasi, 1968; Cronbach, 1984). In order to review the items, the method followed as adapted from Lawshe (1975) was followed. The list of 30 items was given to twelve experts from ICT area to rate how relevant the items were to measure computer self-efficacy of student teachers. A three-point scale (1 = not necessary, 2 = useful, but not necessary, and 3 = essential) was used by them to rate the items. These responses were analysed to calculate the Content Validity Ratio (CVR) for each item.23 items with a CVR greater than 0.5 were retained in the scale for administration.

Administration of the Items to a Development Sample

The scale with 23 items was administered to a sample of 224 student teachers who were about to complete their B Ed course, since for scale development a large sample would eliminate subject variance (DeVellis, 1991). Tinsley and Tinsley (1987) suggest a ratio of 5 to 10 subjects per item. Thus, distribution of the questionnaire containing 23 items to a sample size of 224 was considered satisfactory.

Analysis of the psychometric properties

The items were scored as indicated in Step 2. The reliability alpha coefficient for the scale with 23 items was 0.94, which indicated that the items in the scale were highly inter correlated and were all measuring the same attribute, i.e. computer self-efficacy.

REFERENCES

Anastasi, A. (1968) *Psychological Testing.* Macmillan, London.

Bandura, A. (1986) *Social Foundations of Thought and Action: A Social Cognitive Theory.* Prentice-Hall, Englewood Cliffs, NJ.

Burkhardt, M. E. & Brass, D. J. (1990) Changing pat terns or patterns of change: the effects of a change in technology on social network structure and power, *Administrative Science Quarterly* 35, 91, 104- 127.

Compeau D. R. & Higgins, C. A. (1995) Computer Self-Efficacy: Development of a Measure and Initial Test, *MIS Quarterly* 19, 2, 189-211. Retrieved on 05/01/2009 from http://www.jstor.org/stable/249688.

Cronbach, L. J. (1984) *Essentials of Psychological Testing.* Harper & Row, Cambridge, MA.

DeVellis, R. (1991) *Scale Development: Theory and Applications.* Sage, Newbury Park.
Eachus, P. (1993) Development of the health student self-efficacy scale. *Perceptual and Motor Skills* 77, 670.
Eachus, P. & Cassidy, S. (1997) *Self-Efficacy, Locus of Control and Styles of Learning as Contributing Factors in the Academic Performance of Student Health Professionals.* Proceedings of the First Regional Congress of Psychology for Professionals in the Americas, Mexico City.
Eachus, P & Cassidy, S (2008) *Computer Self-efficacy*. Retrieved on 10/7/2009 from http://www.salford.ac.uk/healthSci/selfeff/selfeff.htm.
Gist M. E., Schwoerer, C. E. & Rosen, B. (1989) Effects of Alternative Training Methods on Self-efficacy and Performance in Computer Software Training, *Journal of Applied Psychology* 74, 6, 884-91.
Hill, T., Smith, N. D. & Mann, M. F. (1987) Role of efficacy expectations in predicting the decision to use advanced technologies: the case of computers; *Journal of Applied Psychology* 72, 2, 307-313.
Lawshe, C.H. (1975) A qualitative approach to content validity. *Personnel Psychology* 28, 4, 563-575.
Porter, L. W. & Lawler, E. E. (1968) *Managerial Attitudes and Performance.* Richard D. Irwin, Homewood, IL.
Rotter, J. B. (1966) Generalised expectancies for internal versus external control reinforcement. *Psychological Monographs.* 80, 1.
Schwarzer R (1993) *Measurement of Self Perceived Self- Efficacy: Psychometric Scales for Cross Cultural Research.* Freie Universitat, Berlin.
Tinsley, H. E. A. & Tinsley, D. J. (1987) Uses of factor analysis in counseling psychology research, *Journal of Counseling Psychology* 34, 414-424.
Webster, J. & Martocchio, J.J. (1992) Microcomputer playfulness: development of a measure with workplace implications. *MIS Quarterly* 16, 2, 201-226.