Asian Journal *of* Distance Education

http://www.AsianJDE.org

ISSN 1347-9008 Asian J D E 2007 vol 5, no 1, pp 27 - 33

Development and Factor Analysis of an Instrument to measure Faculty Attitude towards e-Learning

Sanjaya MISHRA, & Santosh PANDA
Indira Gandhi National Open University, India
s-mishra@ignou.ac.in

ABSTRACT :

This article describes the process of the development of an empirically-based psychometrically-sound instrument to measure faculty attitude towards e-learning. In order to accelerate the acceptance of e-learning and implementation of institution-wide adoption of e-learning in single-mode distance teaching institutions, it is important to understand faculty attitude and accordingly plan for managing the change process. The 12-item attitude towards e-learning scale developed shows a high probability of differentiating between positive and negative attitudes towards e-learning. However, the authors suggest that the scale may be used alongside a 'social desirability scale' to reduce the limitations of attitude measurement.

1. INTRODUCTION :

Fueling an exponential growth in e-learning, more and more education and training institutions are jumping onto the e-learning bandwagon, particularly because of the numerous advantages it provides to the students as well as to the institution in terms of increased revenue (Kosak *et al,* 2004). The single-mode distance teaching institutions are under pressure to expand their media repository and also to achieve economies of scale. Notwithstanding the adoption of e-learning and its innovative deployment, it is being increasingly realized that the role of faculty in the whole process is highly significant. Teachers who play the dual role of being subject-matter experts as well as technology specialists (Sherry, 1995) are the real innovators in the teaching-learning system. Evans & Leppman (1968) concluded that faculty receptivity to innovation is highly innovation-specific, and is also based on individual considerations of feasibility, desirability and familiarity. However, despite the popularity of e-learning, there is a lack of clear consensus on the attitude and ability of academic staff in higher education to participate in these developments (Newton, 2003). Faculty attitude towards online instruction affects their willingness to teach online (Kosak *et al,* 2004).

There are number of studies (Olcott & Wright, 1995 ; Fabry & Higgs, 1997 ; Pajo & Wallace, 2001 ; Sellani & Harrington, 2002 ; Naidu, 2004 ; Kosak *et al,* 2004 ; Jamlan, 2004 ; Lee & Busch, 2005) which have identified significant barriers to staff participation in web-based instruction. Yet there is no standardized instrument to measure faculty attitude towards e-learning. When planners and managers understand how faculty react to a new innovation and what the new experiences mean to them, then their planning becomes more effective and the decisions made might be more acceptable to the faculty. This is particularly true to technology-enabled systems like distance education. If teachers are not comfortable with the technology, students may suffer leading to a poor reputation for the program and the institution. Positive attitudes can help teachers to deal with the new situation with less stress and so enable them to take steps

appropriately in tune with the need of the students and the institution.

The goal of the present study was to offer distance education policy makers and researchers a psychometrically sound and powerful method of assessing faculty attitudes towards e-learning. While the development of a questionnaire based on literature review is a necessity, it is not sufficient for defining the components of a measurement tool. Therefore, a subsequent step is to determine the internal consistency of the items for determining future predictability of the instrument. For this purpose, we followed the scale development guidelines and steps suggested by DeVellis (1991). In this paper, we report the series of steps followed in the development of the scale to assess faculty attitude towards e-learning, starting from generation of an item pool to optimization of the scale. The steps followed were as follows ;

Step 1. Generating an item pool
Step 2. Determining the format for measurement
Step 3. Content validity and review by experts
Step 4. Administration of the items to a development sample
Step 5. Analysis of the psychometric properties
Step 6. Optimization of the scale

2. METHODS :

While following the above steps identified by DeVellis (1991), the study followed review of the relevant literature to generate a pool of items, followed by expert review and questionnaire-based survey of faculty members at an open mega-university to develop a reliable and valid scale. The university is a leader in distance learning with many online projects being carried out at the time of the study. For content validity, nine e-learning experts (with more than five years of experience) rated the items. At the time of the study in early 2005, there were 150 full-time faculty members at the university headquarters, who were requested to respond to the questionnaire. As described in more detail in Step 4 below, the response rate was 53%. Among the respondents 33.3% were female (n=26) and 66.7% were male (n=52). The average age of the sample was 43.7 years with the mean falling in the 41-45 year age group. The average teaching experience of the sample was 15.97 years with the mean falling in the range of 16-20 years. The respondents were highly experienced in the distance education system with an average of 11.69 years. Most of the respondents (43.6%) had 16-20 years of experience in the university. The majority of the respondents were familiar with computers and used them on an almost-daily basis. Only 7.7% (n=6) respondents had undergone some courses as a student through e-learning. It may be noted here that although many online projects were going on in the university at the time of the study, there was no current strategic policy on e-learning.

2.1 Step 1. Generating an Item Pool :

In order to generate a pool of items related to attitude towards e-learning, a comprehensive review and analysis of the available world literature, covering faculty attitude towards distance education (Clark, 1993; Siaciwena, 1989), faculty perceptions about barriers to web-based instructions (Berge, 1998 ; Daugherty & Funke, 1998 ; Berge & Mrozowski, 1999 ; Schifter, 2000 ; Pajo & Wallace, 2001 ; Newton, 2003 ; Jamlan, 2004 ; Naidu, 2004 ; Lee & Busch, 2005) and numerous publications on students' perceptions of e-learning was undertaken (see for example, Keller & Cernerud, 2002 ; Graff, 2003 ; Paris, 2004 ; Muilenberg & Berge, 2005 ; Drennam *et al,* 2005 ; Thompson & Ku, 2005). At this stage, a list of 29 items were identified that reflected a potential correlation with the concept of e-learning. The pool of items included both positively and negatively worded statements.

2.2 Step 2. Determining the Format of the Scale :

At this stage, different scaling options were investigated. From this, the Likert scale was chosen for its simplicity, wide use in attitude measurement, higher reliability

coefficients with fewer items, and method of summated ratings (Edwards & Kenney, 1946). Thus, for each statement we used the following five-point agreement / disagreement scale given with the numerical values assigned to each point (which was reversed for negative items) ;- 5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree, and 1 = strongly disagree.

2.3 Step 3. 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 attitudinal domain content (Anastasi, 1968 ; Cronbach, 1984). In order to review the items, the method followed by Biner (1993) as adapted from Lawshe (1975) was followed by us. The list of 29 items was given to nine e-learning experts to rate how relevant the items were to measure attitude towards e-learning. 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 analyzed to calculate the Content Validity Ratio (CVR) for each item. The 22 items with a CVR greater than zero were included in the scale for administration. Table 1 shows the CVR scores of these 22 selected items.

Table 1 : Items with a Content Validity Ratio greater than Zero

Item	The Item Statement	CVR
1	e-Learning will never replace other forms of teaching and learning.	.11
2	e-Learning makes me uncomfortable because I do not understand it.*	.55
3	e-Learning is a de-humanizing process of learning.*	.33
4	e-Learning can solve many of our educational problems.	1.00
5	I feel intimidated by e-learning.*	.55
6	e-Learning will bring new opportunities for organizing teaching and learning.	1.00
7	e-Learning is difficult to handle and therefore frustrating to use.*	.11
8	There are unlimited possibilities of e-learning that have not yet been thought about.	.11
9	e-Learning saves time and effort for both teachers and students.	.77
10	e-Learning increases access to education and training.	.33
11	e-Learning will increase my efficiency in teaching.	.55
12	e-Learning enables collaborative learning.	1.00
13	e-Learning can engage learners more than other forms of learning.	.77
14	e-Learning increases the quality of teaching and learning because it integrates all forms of media ; print, audio, video, and animation.	1.00
15	e-Learning increases the flexibility of teaching and learning.	.33
16	e-Learning improves communication between students and teachers.	.77
17	e-Learning enhances the pedagogic value of a course.	.55
18	I get a sinking feeling when I think of trying to use e-learning for my courses.*	.33
19	e-Learning is not effective for student learning.*	.55
20	e-Learning experiences cannot be equated with those of face-to-face teaching or even distance education.*	.33
21	It is essential that e-learning material be of high quality.	.11
22	Open universities should adopt more and more e-learning for their students.	.77

** Negatively worded statements*

2.4 Step 4. Administration of the Items to a Development Sample :

The scale with 22 items was distributed to a sample of 150 teachers in the university; 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, i.e. up to a sample size of about 300 for factor analysis. Thus, distribution of the questionnaire containing 22 items to a sample size of 150 was considered satisfactory. However, only 78 (52%) filled-in questionnaires were returned for analysis. Though this was considered as a limitation at this stage, the analysis of the responses found that this return rate was adequate for this instrument.

3. RESULTS :

In Steps 5 and 6, the results of the analyses of the responses by the faculty members to the 22 items in the scale are presented. Factor analysis revealed two underlying variables in the scale ;- a *functional* factor and an *individualistic* factor. The reliability test of the scale showed a high intercorrelation among the items : the value of the alpha coefficient increased by decreasing the items in the scale making the recommended scale more robust and reliable.

3.1 Step 5. Analysis of the Psychometric Properties :

The items were scored as indicated in Step 2, with the seven negative items in the scale being reverse scored. The reliability alpha coefficient for the scale with 22 items was 0.81, which indicated that the items in the scale were highly intercorrelated and were all measuring the same attribute, i.e. attitude towards e-learning. With this, we were interested in understanding how many constructs or latent variables underlay the set of 22 items in the scale. Therefore, we performed exploratory factor analysis on the sample. The Kaiser-Guttman eigen-value criterion greater than or equal to one (Catell, 1966) resulted in six factors (Table 2). Additionally Catell's (1966) scree test (Figure 1) revealed an 'elbow' at 3 calling for retaining only 2 factors.

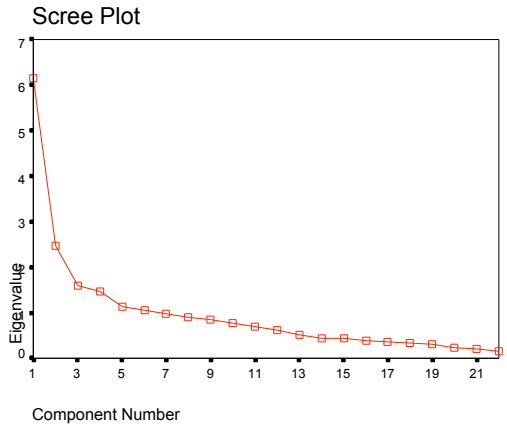

Figure 1 : The scree plot

Table 2 : The Six Factors extracted with an Eigen Value greater than One

Component	Eigen Value	% of Variance	Cumulative %
1	6·149	27·949	27·949
2	2·480	11·275	39·223
3	1·585	7·207	46·430
4	1·476	6·707	53·137
5	1·128	5·126	58·263
6	1·066	4·844	63·107

Table 3 : The 17 Items of Factor 1 and Factor 2

Item	The Item Statement	Factor 1	Factor 2
4	e-Learning can solve many of our educational problems.	**0·727**	- 0·270
6	e-Learning will bring new opportunities for organizing teaching and learning.	**0·547**	- 0·216
9	e-Learning saves time and effort for both teachers and students.	**0·571**	--
10	e-Learning increases access to education and training.	**0·744**	- 0·184
11	e-Learning will increase my efficiency in teaching.	**0·807**	--
12	e-Learning enables collaborative learning.	**0·676**	- 0·167
13	e-Learning can engage learners more than other forms of learning.	**0·526**	- 0·137
14	e-Learning increases the quality of teaching and learning because it integrates all forms of media ; print, audio, video, and animation.	**0·658**	- 0·146
15	e-Learning increases the flexibility of teaching and learning.	**0·767**	- 0·158
16	e-Learning improves communication between students and teachers.	**0·661**	--
17	e-Learning enhances the pedagogic value of a course.	**0·616**	--
22	Open universities should adopt more and more e-learning for their students.	**0·623**	--
2	e-Learning makes me uncomfortable because I do not understand it.*	0·258	**0·622**
3	e-Learning is a de-humanizing process of learning.*	0·223	**0·544**
5	I feel intimidated by e-learning.*	--	**0·503**
18	I get a sinking feeling when I think of trying to use e-learning for my courses.*	0·348	**0·630**
19	e-Learning is not effective for student learning.*	0·219	**0·669**

Note : Figures in bold are items with loading more than 0.5

Table 3 shows the factor loading of the items with a loading of 0.50 or greater. Interestingly, 12 items in Factor 1 had a loading ranging from 0.526 to 0.807 and were positively worded, while the 5 items in Factor 2 had a loading from 0.544 to 0.669 and were all negatively worded. Thus, we could identify two factors – Factor 1 involving 12 items that were related to the attributes of e-learning and therefore this Factor 1 was described as the *functional* factor, and Factor 2 involving 5 items that were related to the respondents' feelings about e-learning and was therefore termed the *individualistic* factor.

3.2 Step 6. Optimization of the Scale :

The factor analysis identified 17 items in two groups, as Factor 1 and Factor 2, and the Cronbach reliability alpha coefficient for the 17-item scale was 0.84. We then investigated further optimization of the instrument by examining the reliability coefficient of each factor independently. We then found that the 12-item Factor 1 had a reliability coefficient of 0.88 thereby indicating high inter-item correlation within this Factor 1, and indicating that this factor alone could be used to comprise an instrument to measure faculty attitude towards e-learning.

4. LIMITATIONS AND CONCLUSION :

The attitude scale of Factor 1 alone consisting of the 12 positively worded inter-related items termed the *functional* factor showed satisfactory psychometric properties and a high probability of differentiating between positive and negative attitudes towards e-learning. Though the sample size was low with only an initial 22 items in the scale, the final extraction of 12 items was highly satisfactory with a sample size of 78. The scale can be used alongside any other standard scale in a printed form. The demographic variables that may be appended to the instrument may include gender, age group, discipline, teaching experience, familiarity with computers, with e-mail, with the internet, and experience of e-learning.

Though the items in the scale had been reviewed by selected experts and included on the basis of Content Validity Ratio (CVR), there is always some chance that respondents may not have answered consistently with their own beliefs – in other words some interviewer effect or Hawthorne effect might have been present. Further investigation on a larger or different sample may accordingly be warranted. However, generally there is an inherent assumption in attitude measurement that we may reasonably expect respondents to accurately reflect their own held beliefs (Thurstone, 1938). The respondents' 'social desirability' motivation to show a positive disposition could be investigated by adding a 'social desirability scale' such as that developed by Strahan & Gerbasi (1972) alongside the present 12-item 'attitude towards e-learning scale'. Since the scale will help distance-teaching institutions to identify positive and negative faculty attitudes towards e-learning, policy makers and planners will be in a better position to manage change and implement an organization-wide e-learning strategy. As attitudes naturally change over time, it is possible for planners and managers to change any negative pre-disposition among faculty through interventional information communication, training and experience.

Furthermore, it is hoped the present instrument developed will encourage researchers to use it and test it out in conjunction with other psychological variables to develop a better understanding of successful and unsuccessful implementations of e-learning.

REFERENCES :

Anastasi, A. (1968). *Psychological testing*. London : Macmillan.

Berge, Z. (1998). Barriers to online teaching in post-secondary institution. *Online Journal of Distance Education Administration, 1* (2). Retrieved May 10, 2006, from http://www.westga.edu/~distance/Berge12.html

Berge, Z.L., & Mrozowski, S. (1999). Barriers to online teaching in elementary, secondary and teacher education. *Canadian Journal of Educational Communication, 27* (2), 59-72.

Biner, P.M. (1993). The development of an instrument to measure student attitudes towards televised courses. *American Journal of Distance Education, 7*(1), 62-73.

Catell, R.B. (1966). The scree test for the number of factors. *Multivariate Behavioural Research, 1*, 245-276.

Clark, T. (1993). Attitudes of higher education faculty towards distance education : A national survey. *American Journal of Distance Education, 7* (2), 19-33.

Cronbach, L.J. (1984). *Essentials of psychological testing*. Cambridge, MA : Harper & Row.

Daugherty, M., & Funke, B.L. (1998). University faculty and student perceptions of web-based instruction. *Journal of Distance Education, 13* (1), 21-39.

DeVellis, R. (1991). *Scale development: Theory and applications*. Newbury Park : Sage.

Drennam, J., Sarski, A.P., & Kennedy, J. (2005). Factors affecting student attitudes towards flexible online learning in management education. *Journal of Educational Research, 98* (6), 331-338.

Edwards, A.L., & Kenny, K.C. (1946). A comparison of the Thurstone and Likert techniques of attitude scale construction. *Journal of Applied Psychology, 30*, 72-83.

Evans, R.I., & Leppman, P. (1968). *Resistance to innovation in higher education : A social psychological exploration focused on TV and the establishment*. San Francisco: Jossey-Bass.

Fabry, D.R., & Higgs, J.R. (1997). Barriers to the effective use of technology in education: Current status. *Journal of Educational Computing Research, 17* (4), 385-395.

Graff, M. (2003). Cognitive style and attitudes towards using online learning and assessment methods. *Electronic Journal of e-Learning, 1* (1), 21-28.

Jamlan, M. (2004). Faculty opinions towards introducing e-learning at the University of Bahrain. *International Review of Research in Open and Distance Learning, 5* (2). Retrieved May 10, 2006, from http://www.irrodl.org/index.php/irrodl/article/view/185/267

Keller, C., & Cernerud, L. (2002). Students' perception of e-learning in university education. *Journal of Educational Media, 27* (1-2), 55-67.

Kosak, L., Manning, D., Dobson, E., Rogerson, L., Cotnam, S., Colaric, S., & McFadden, C. (2004). Prepared to teach online? Perspectives of faculty in the University of North Carolina System. *Online Journal of Distance Learning Administration, 7* (3). Retrieved May 10, 2006, from http://www.westga.edu/%7Edistance/ojdla/fall73/kosak73.html

Lawshe, C.H. (1975). A qualitative approach to content validity. *Personnel Psychology, 28* (4), 563-575.

Lee, J.A., & Busch, P.E. (2005). Factors related to instructors' willingness to participate in distance education. *Journal of Educational Research, 99* (2), 109-115.

Muilenberg, L.Y., & Berg, Z.L. (2005). Student barriers to online learning: a factor analytic study. *Distance Education, 26* (1), 29-48.

Naidu, S. (2004). Trends in faculty use and perceptions of e-learning. *Asian Journal of Distance Education, 2* (2). May 10, 2006, http://www.asianjde.org/2004v2.2.Naidu.pdf

Newton, R. (2003). Staff attitude to the development and delivery of e-learning. *New Library World, 104* (1193), 412-425.

Olcott, D., & Wright, S.J. (1995). An instructional support framework for increasing faculty participation in post-secondary distance education. *American Journal of Distance Education, 9* (3), 5-17.

Pajo, K., & Wallace, C. (2001). Barriers to the uptake of web based technology by university teachers. *Journal of Distance Education, 16* (1), 70-84. Retrieved May 10, 2006, from http://cade.athabascau.ca/vol16.1/pajoetal.html

Paris, P.G. (2004). E-learning : A study on secondary students' attitude towards online web assisted learning. *International Education Journal, 5* (1), 98-112.

Schifter, C.C. (2000). Faculty participation in asynchronous learning networks : a case study of motivating and inhibiting factors. *Journal of Asynchronous Learning Networks, 4* (1), 15-22.

Sellani, R.J., & Harrington, W. (2002). Addressing administrator / faculty conflict in an academic online environment. *Internet and Higher Education, 5*, 131-145.

Sherry, L. (1995). Issues in distance learning. *International Journal of Educational Telecommunication, 1*, 337-365.

Siaciwena, R.M.C. (1989). Staff attitudes towards distance education at the university of Zambia. *Journal of Distance Education, 4* (2), 47-62.

Strahan, R., & Gerbasi, K. (1972). Short homogeneous version of the Marlowe-Crowne social desirability scale. *Journal of Clinical Psychology, 28*, 191-193.

Thompson, L., & Ku, Heng-Yu. (2005). Chinese graduate students' experiences and attitudes towards online learning. *Educational Media International, 42* (1), 33-47.

Thurstone, L.L. (1938). Attitudes can be measured. *American Journal of Sociology, 33*, 529-554.

Tinsley, H.E.A., & Tinsley, D. J. (1987). Uses of factor analysis in counseling psychology research. *Journal of Counseling Psychology, 34*, 414-424.

Sanjaya MISHRA (email : sanjayamishra@hotmail.com and s-mishra@ignou.ac.in), is co-Editor of the Asian Journal of Distance Education and Reader in Distance Education, and Santosh PANDA (email : spanda@ignou.ac.in) is Professor of Distance Education and Director, at the Staff Training and Research Institute of Distance Education (STRIDE), Indira Gandhi National Open University, Maidan Garhi, New Delhi 110068, India, Telephone : 91 11 29535399, Facsimile : 91 11 29533073.