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A Practical and Theoretical Approach to Assessing Computer Attitudes: The Computer Attitude Measure (CAM)

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Abstract

In this study, the Computer Attitude Measure (CAM) was administered to 383 student teachers to assess three relatively distinct dimensions of computer attitudes: cognitive, affective and behavioral. The alpha coefficients for each subscale (cognitive ($\alpha = .87$), affective ($\alpha = .89$), behavioral ($\alpha = .94$) showed a high degree of internal reliability. The principal component factor analysis supported the a priori assumption that the three subscales were independent. Finally, significant positive correlations ($p < .001$) of all subscales with a high degree of computer literacy and experience, and an internal locus of control, supported the external validity of the Computer Attitude Measure (CAM). (Keywords: attitudes, teacher training, measurement.)

Since 1970, numerous measures have been developed to assess attitudes toward computers in an effort to predict computer-related behavior. A majority of measures, though, have proven to be either statistically weak or theoretically vague. A somewhat biased selection of subjects coupled with insufficient sample size was the most common statistical problem. For example, Ellsworth and Bowman's (1982) "Beliefs about Computers" scale was tested using a relatively small and somewhat specific population of 109 introductory biology students and 31 computer science majors. Williams, Coulombe, and Lievrouw (1983) assessed attitudes of 10-14 year old children at a computer camp. A bias towards computer experience reduced the statistical merit of this assessment device. Reece and Gable (1982) developed a comprehensive scale examining cognitive, affective and behavioral aspects of computer attitudes, although the measure was directed solely at grade seven and eight students. Finally, the generalizability of Quintar, Crowell, Pryor, and Adamopolous's (1982) semantic differential scale has to be questioned with a sample size of only 26. A larger, more diverse sample size would strengthen any conclusions drawn from these studies.

Several conscientious attempts to develop statistically robust measures of computer attitudes have been overshadowed by an absence of theoretical discourse. In 1970, Lee conducted a nationwide computer attitude survey. At the time, considerable variability was left unaccounted for in this measure. Today, Lee's measure would be conspicously dated, especially in light of the microcomputer. Loyd and Gressard (1984, 1985) and Gressard and Loyd (1986) reported good internal reliability and factor validity on their computer attitude scale, although the theoretical differentiation among subscales was hazy. Two of the three subscales, anxiety and confidence, appeared to be points at opposite ends of the same continuum.

The present study assesses attitudes toward computers using a multicomponent model, incorporating cognitive and affective attitudes toward computers. This

approach to assessing attitudes has been used by numerous investigators (Allport, 1935; Cartwright, 1949; Katz & Stotland, 1959; Krech & Crutchfield, 1948; Rosenberg & Hovland, 1960; Smith, 1947). Ajzen and Fishbein (1980) argued that the multicomponent model, though, has met with limited success in terms of predicting behavior. They suggest assessing the social desirability of a specific behavior to improve the predictive value of an attitude measure. Therefore, a third subscale, assessing the behavioral desirability of performing computer-related behaviors was added to the Computer Attitude Measure (CAM) in this study.

Also, in accordance with Ajzen and Fishbein's (1977, 1980) theory of reasoned action, the target (the computer) and the action (using the computer) of a particular belief are maintained constant for all items in the CAM. In other words, affective, cognitive and behavioral attitudes all refer to the same action and target, namely, "use of the computer."

METHOD

The sample consisted of 383 students (33% male, 67% female), ranging in age from 22 to 51 years ($M = 27.2$ years), enrolled in the Faculty of Education at the University of Toronto. The majority of students had obtained their Bachelor's degree (79%), although 20% had acquired their Master's degree and 1% had their Doctoral degree. Of the 383 subjects, 18% (6 males, 64 females) intended to teach primary/junior pupils (junior kindergarten to grade 6), 21% (17 males, 63 females) intended to teach junior/intermediate pupils (grades 4 to 10) and 61% (104 males, 128 females) intended to teach intermediate/senior pupils (grades 7 to 12). Regarding the subject areas to be taught, 25% (50 males, 45 females) of students were planning to teach math-science-business oriented courses, 49% (54 males, 133 females) to teach the humanities, and the remaining 26% (23 males, 77 females) to teach a general curriculum.

Description of Computer Attitude Scale

The Computer Attitude Measure (CAM) consisted of the following sections: (a) demographic information, (b) cognitive attitudes, (c) affective attitudes and (d) behavioral attitudes. Gender, age, teaching level, subject area to be taught, highest level of education attained, and principle subject matter of last degree made up the demographic questions.

The cognitive attitude dimension consisted of 10 seven-point Likert items (Strongly Disagree, Disagree, Slightly Disagree, Neutral, Slightly Agree, Agree, Strongly Agree). The affective component of attitudes was assessed using ten, 7-point semantic differential scale items (Extremely, Moderately, Slightly, Neither, Slightly, Moderately, Extremely). The behavioral attitude scale was comprised of 10 seven-point Likert items (Extremely Unlikely, Unlikely, Somewhat Unlikely, Neither, Somewhat Likely, Likely, Extremely Likely). For this subscale subjects were asked, "If it were only up to you and no one else, how likely is it that you would perform each of the following behaviors in the next 6 months." Individual item statements are listed in Table 1.

Three other scales were administered at the same time as the CAM, assessing computer literacy (24 items, $\alpha = .93$), computer experience (number of course taken, years of computer use, and typical weekly use) and locus of control specific to the use of computers (14 items, $\alpha = .89$).

Table 1
Item Statements for Computer Attitude Measure (CAM)

Item Statement
Cognitive Scale (7-point Likert Scale)
1. Computers would help me more creative.
2. Computers would not significantly improve the quality of education for my students.
3. Computers would help make my work more interesting.
4. It is important that I keep up with educational computer innovations.
5. I would not need a computer in my classroom.
6. My student's mental abilities would improve significantly by interacting with computers.
7. Computers would make my students lose valuable skills.
8. Computers would help me be more productive.
9. Computers would motivate my students to do better work.
10. Computers would make my life in the classrooms more difficult.
Affective Scale (7-Point Semantic Differential Scale)
1. Unlikable - Likable
2. Good - Bad
3. Unhappy - Happy
4. Uncomfortable - Comfortable
5. Calm - Tense
6. Empty - Full
7. Natural - Artificial
8. Exciting - Dull
9. Suffocating - Fresh
10. Pleasant - Unpleasant
Behavior Scale (7-point Likert scale)
1. Use a word processor
2. Use a computer on a regular basis.
3. Do a significant task on a computer.
4. Buy or borrow computer software or hardware.
5. Use a disk operating system.
6. Investigate different kinds of software
7. Work with computer-aided instruction.
8. Experiment with a new computer software package.
9. Work with a computer graphics package.
10. Use data-base software.

Procedure

Professors from the Educational Psychology Department were asked to volunteer 15 minutes of class time to distribute the CAM. Four out of seven professors agreed to have their students fill out the survey during class time. A fifth professor agreed to have the survey handed out, but not completed during class. Eighteen classes participated in the survey.

Before the surveys were handed out, it was stressed that participation was completely optional and that students electing not to do the survey could take a 15 minute coffee break. Students were told that the survey was being used to obtain information about the use of computers in education and that the data would be used for a Master's thesis. The students were also encouraged to pick up a one page "debriefing" summary after they had filled out the survey.

Of the 387 surveys handed out and completed in the classroom, 372 (96%) were returned. Of the 78 surveys handed out, but not filled in during class, 11 (14%) were returned. Overall 383 of 465 (82%) of the surveys handed out were completed.

Research Design and Method of Analysis

The means, standard deviations and internal reliability coefficients were determined for each of the three subscales. A principal component factor analysis, followed by a varimax rotation of the factor solution was used to determine the factor validity of the CAM. Finally a correlation matrix incorporating the three CAM subscales and the measures of computer literacy, experience and locus of control was generated to demonstrate the external validity of the CAM.

RESULTS

The means for all three subscales fluctuated from 3.3 to 5.7. The standard deviations for individual items ranged from 1.1 to 2.3. The alpha coefficients for the cognitive, affective and behavioral subscales were relatively high at .87, .89 and .94 respectively (see Table 2). The internal reliability coefficient for the total scale was .94. The total test means for cognitive ($M = 50.5$) and affective ($M = 48.1$) attitudes were greater than the mean for behavioral ($M = 41.4$) attitudes.

The principal component factor analysis produced a three factor solution accounting for 55% of the total variance. The varimax rotated factor loadings greater than .40 are shown in Table 3. Each of the three CAM subscales produced a relatively distinct and cohesive group.

All correlations among cognitive, affective and behavioral attitudes, a high degree of computer literacy and computer experience, and an internal locus of control were positive and significant ($p < .001$). The pattern of correlations for the affective subscale was simliar to the cognitive subscale. Correlation coefficients for the behavioral subscale were consistently higher than the other two CAM subscales (Table 4).

DISCUSSION

The purpose of the study was to develop a statistically sound measure of computer attitudes that was theoretically and practically relevant.

The sample, although chosen by convenience, was sufficiently large and diverse to lend statistical merit to the results. The item means and standard deviations were relatively consistent for all subscales. The high alpha coefficients for all three computer attitude dimensions indicate that the subscales are internally reliable. Furtherfore, the results from the factor analysis suggest that the three subscales measure distinct aspects of computer attitudes. Finally, significant correlations among positive cognitive, affective and behavioral attitudes, a high degree of computer literacy and experience, and an internal locus of control provide a measure of external validity for the CAM. In other words, we would expect positive

Table 2
Means and Inter-Item Correlations for CAM Subscales ($N = 383$)

	Item	*Mean*	*S.D.*	*Inter-Item Correlation*
Cognitive	1.	4.6	1.8	.64
	2.	5.2	1.5	.65
	3.	4.9	1.5	.67
	4.	5.6	1.2	.50
	5.	5.1	1.7	.60
	6.	4.6	1.6	.59
	7.	5.0	1.7	.52
	8.	5.5	1.3	.59
	9.	4.7	1.4	.63
	10.	5.2	1.4	.58
Total Subscale		50.5	10.3	.87 *
Affective	1.	5.1	1.5	.62
	2.	5.7	1.3	.57
	3.	5.0	1.2	.72
	4.	4.7	1.5	.69
	5.	4.1	1.5	.59
	6.	4.6	1.1	.54
	7.	4.6	1.2	.66
	8.	4.6	1.2	.66
	9.	4.6	1.2	.66
	10.	5.1	1.4	.79
Total Subscale		48.1	9.6	.89 *
Behavior	1.	5.3	1.8	.66
	2.	4.4	2.1	.79
	3.	4.8	2.0	.72
	4.	4.1	2.3	.78
	5.	4.4	2.2	.78
	6.	3.6	2.1	.78
	7.	4.3	1.9	.68
	8.	3.9	2.0	.77
	9.	3.3	1.9	.71
	10.	3.5	2.0	.76
Total Subscale		41.4	16.2	.94 *

* - Cronbach alpha coefficient for subscale

Table 3
Varimax Rotated Factor Loadings for
Cognitive and Affective Computer Attitude Subscales

Subscale	*Item*	*Factor 1*	*Factor 2*	*Factor 3*
Behavior	5	.80		
	4	.80		
	8	.80		
	6	.79		
	10	.78		
	2	.77		
	9	.73		
	3	.71		
	1	.69		
	7	.68		
Affective	3		.79	
	10		.75	
	8		.70	
	2		.68	
	4		.67	
	1		.63	
	9		.62	
	6		.62	
	5		.55	
	7		.44	
Cognitive	1			.71
	3			.70
	6			.68
	9			.67
	2			.67
	8			.63
	5			.60
	4			.52
	7			.44
	10			.41

Table 4
Correlations Among CAM Subscales, Computer Literacy, Experience and Locus of Control

Scale	*Com. Lit.*	*Com. Exp.**	*Locus Ctrl.*	*CogAtt*	*AffAtt*	*BehAtt*	*TotScale*
Cognitive	.36	.36	.44	1.00	.63	.49	.81
Affective	.42	.34	.53		1.00	.47	.79
Behavior	.66	.51	.66			1.00	.86
Total Scale	.61	.51	.66				1.00

Note. All correlations are significant at $p<.001$
*$N=379$

attitudes toward computers to correlate with strong computer related skills and a perceived high degree of control over the computer, and this speculation is confirmed.

Note that the results of this study are reflective of student teachers. The internal reliability and factor validity results apply to this population only.

CONCLUSION

A multicomponent Computer Attitude Measure (CAM), incorporating cognitive, affective and behavioral subscales was tested on 383 student teachers. The independence of these subscales was supported by a principal component factor analysis. As well, the CAM was internally reliable and correlated positively with a high degree of computer literacy and experience, and an internal locus of control.

Contributor

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