An Internet survey for perceptions of computers and the World Wide Web: relationship, prediction, and difference

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Abstract

The study focused on three purposes. The first purpose was to examine the relationship between computer attitudes and Web attitudes. The second object was to find the predictor variables on computer attitudes and Web attitudes. And the third purpose was to discuss the differences of demographic factors on computer attitudes and Web attitudes. Moreover, advantages and limitations of the Internet survey were also discussed in this study. The findings showed that there had a significantly positive correlation between students' computer attitudes and Web attitudes. It implied that computer attitudes and Web attitudes could provide concurrent validity to each other. In other words, previous studies of computer attitude scale might be available for surveying learners' attitudes toward the Web. In addition, students' experience in word processors and experience using the Internet/WWW were predictors for both computer attitudes and Web attitudes. Furthermore, the results presented that male students had more positive perceptions toward computer and Web technologies. The results also indicated when students had more years in computer-related experience; they had more positive perceptions to computer and Web technologies. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Computer attitudes; Web attitudes; Internet survey

1. Introduction

Information technology designed for educational purposes has fundamentally altered modern education, especially in schools. With the enormous advances in communication and computer technology, the educational system urgently needs the application of this technology in order to enhance the quality of teaching and...
learning. Although computers have the potential for improving teaching and learning, Maddux, Johnson, and Willis (1997) stated "After all, the computer is a tool, and, like any tool, it can be poorly used or misused" (p. 2). Because computers are tools, understanding their "appropriate use" in schools is crucial (Provenzo, Brett, & McCloskey, 1999). Essentially, computers cannot improve organizational performance unless they are used appropriately (Davis, Bagozzi, & Warsaw, 1989). In numerous studies, the success of computer utilization was largely dependent upon the faculty and learners' attitudes toward computers (Al-Khaldi & Al-Jabri, 1998; Anderson, 1996; Ayersman, 1996; Brock & Sulsky, 1994; Culpan, 1995; Harrison & Rainer, 1992; Havice, 1994; Mitra, 1998; Pancer, George, & Geboetsy, 1992; Winter, Chudoba, & Gutek, 1998).

Since the Internet and the World Wide Web (WWW or Web) are widely popular, the use of Web technologies as a teaching and learning tool that based on the Web system is now rapidly expanding into education. Researchers and educators have already realized the potential of Web technology in education. Many studies indicated that past success of Web utilization was largely dependent upon users' attitudes toward the Web (Daugherty, & Funke, 1998; Fenech, 1998; Johnson & Hignite, 2000; Lederer, Maupin, Sena, & Zhuang, 2000; Liu, Ayersman, & Reed, 1995; Moon & Kim, 2001; Reed & Oughton, 1997; Ruffini, 1999; Takacs, Reed, Weels & Dombrowski, 1999; Welles 1997).

There are not many previous studies to discuss computer attitudes and Web attitudes at the same time; therefore, discovering the relationship, similarity, and differences between computer attitudes and Web attitudes are crucial when using information systems as a learning tool; especially those systems integrated computer and Web technologies. Thus, this study focused on understanding the attitudes toward computers and Web technologies. The relationship between students' perceptions of computers and the Web were examined at first. Additionally, the predictor variables on computer and Web attitudes were detected. Furthermore, the differences of demographic factors on computer and Web attitudes were also discussed. For researching these purposes, this study developed a psychometric questionnaire survey, the Computer and Web Attitudes Survey (CWAS), which comprised two major components, the Computer Attitudes Survey (CAS) and the Web Attitudes Survey (WAS).

2. Computer and Web attitudes

Understanding why people accept or reject information technology has proven to be one of the most important and challenging issues in information system research (Davis et al., 1989). Herbert and Benbasat (1994) found that 77% of the variance of intent to use information technology was explained by attitudes toward computers. In general, no matter how sophisticated and how capable the technology, its effective implementation depends upon users having positive attitude towards it.

Ajzen and Fishbein (1977) specified that "Attitudes toward targets will predict multiple-act criteria, provided that the attitudinal and behavioral entities involve the
same target elements” (p. 981). Triandis (1971) suggested that attitude consists of affective, cognitive, and behavioral components. The affective component of attitude is the emotion or feeling which includes statements of likes or dislikes about some certain objects. The cognitive component of attitude is statements of beliefs. In other words, an individual holds a belief that a certain object can increase significantly the quality of her/his output. And the behavioral component of attitude is what an individual actually does or intends to do (Al-Khaldi & Al-Jabri, 1998).

Although the concept of attitude towards computers has gained recognition as a critical determinant in the use and acceptance of computer technology (Al-Khaldi & Al-Jabri, 1998; Anderson, 1996; Ayersman, 1996; Harrison & Rainer, 1992; Mitra, 1998; Pancer et al., 1992), there is no single, universally accepted definition of computer attitude construct (Smith, Caputi, & Rawstorne, 2000). As noted by Kay (1993), attitude toward computers has been defined in over 14 different ways in the computer research literature. One approach to defining this psychological construct is to draw on contemporary theorizing in the general area of attitudes. The Computer Attitude Measure (CAM), developed by Kay (1989) and consistent with Ajzen and Fishbein’s (1977, 1980) theoretical position, was defined as a person’s general evaluation or feeling of favorableness or unfavorableness toward computers and specific computer-related activities. CAM was composed of demographic information, cognitive, affective, and behavioral attitudes. Ajzen and Fishbein (1980) argued that a multi-component model should assess the social desirability of a specific behavior to improve the predictive value of an attitude measure. Thus, the CAM included the behavioral desirability of performing computer-related behaviors. Based on this viewpoint, the CAM referred to affective, cognitive, and behavioral attitudes for the same action and target, namely, “use of the computer” (Kay, 1989). This measure was administered to students and teachers and yielded high internal reliability coefficients for each subscale (cognitive was $\alpha = 0.97$, affective was $\alpha = 0.89$, and behavior was $\alpha = 0.94$). Kay (1993) revised the CAM for assessing pre-service teachers’ attitudes toward computers. In the revised study, the total internal reliability coefficient was $\alpha = 0.95$.

The Computer Attitude Scale, developed by Loyd and Loyd (1985), consisted of computer anxiety, computer confidence, computer liking, and computer usefulness. Computer anxiety referred to fear of computers or the tendency of a person to be uneasy, apprehensive, and phobic towards current or future use of computers (Igbaria, 1993; Loyd & Loyd, 1985). Computer confidence referred to the ability to use or learn about computers (Gressard & Loyd, 1986). Essentially, computer confidence had been shown to be closely related to computer anxiety (Al-Khaldi & Al-Jabri, 1998; Nash & Moroz, 1997). Computer liking referred to liking or enjoying working with computers (Al-Khaldi & Al-Jabri, 1998). And computer usefulness referred to the degree of perceived usefulness of using computers for present and future work (Al-Khaldi & Al-Jabri, 1998). In general, anxiety, confidence and liking represent the affective or feeling part of attitude and usefulness represents the cognition or belief part of attitude (Thompson, Higgins, & Howell, 1991). In the Computer Attitude Scale, many studies (Al-Khaldi & Al-Jabri, 1998, Kay, 1993; Nash & Moroz, 1997) suggested that computer anxiety and computer confidence were part
of the same continuum. In addition, Woodrow (1991) provided the evidence that the three-scale version of the Computer Attitude Scale had two dimensions, affective and behavioral aspects. Moreover, Nash and Moroz (1997) also suggested that the attitude toward academic endeavors associated with computer training should be incorporated into the Computer Attitude Scale. This part referred to the learning and training of computer courses or skills.

In general, some studies of Web attitudes were based on Technology Acceptance Model (TAM). TAM, was developed from social psychology Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), explained user acceptance of a technology based on user attitudes. A conspicuous difference between the TAM and TRA is that TAM omits subjective norms, mostly because of methodological reasons and partly because they were not significant in explaining behavioral intentions (Davis et al., 1989). TAM suggests that two specific behavioral beliefs, perceived ease of use (EOU) and perceived usefulness (U), determine an individual's behavioral intention to use technologies. Perceived ease of use is the extent to which a person believes that using a technology will be free of effort. Perceived usefulness is the extent to which a person believes that using a technology will enhance his/her productivity (Venkatesh, 1999). In contrast to perceived ease of use, which is process expectancy, perceived usefulness is outcome expectancy. The behavior intention to use technologies leads to actual system use. Previous research has demonstrated the validity of this model across a wide variety of Web systems (Fenech, 1998; Lederer et al., 2000; Lin & Lu, 2000; Moon & Kim, 2001).

The scale of the Computer and Web Attitude Scale (CWAS) is formulated within among the frames for assessing attitudes toward computers set out by CAM (Kay, 1989, 1993), Computer Attitude Scale (Al-Khaldi & Al-Jabri, 1998; Loyd & Loyd, 1985; Nash & Moroz, 1997), and TAM (Davis, et al., 1989; Fenech, 1998; Lederer et al., 2000; Lin & Lu, 2000; Moon & Kim, 2001). The CWAS includes a Computer Attitude Scale and a Web Attitude Scale to discovery individual affective, cognitive, and behavioral attitudes toward computer and Web technologies.

3. Survey using the Internet

From many studies, the advantages of questionnaire using the Internet are lower cost, faster feedback, and fewer missing data (Nowack, 1997; Stanton, 1998; Weible & Wallace, 1998).

Regarding the lower cost, Weible and Wallace (1998) stated that a mail survey was of a higher cost than a fax survey, and e-mail and Web-form surveys had a lower cost than either mail or fax. In their study, the cost structure included fixed costs and variable costs. The fixed costs included preparing the survey instrument and cover letter, setting up the database, and performing a mail merge, etc. Variable costs included printing, papers, collating, stuffing, and so on. According to faster feedback, Nowack (1997) indicated that the Internet provided quick access method for response and feedback. Stanton (1998) noted that the amount of missing data would
be lower for data records collected using the Web than for data records collected using traditional paper and pencil surveys.

Essentially, in the Internet and Web systems, the missing data can be well controlled by using computer-programming languages. This study used Java script computing programs that were tied in Hypertext Markup Language (HTML) to avoid missing data. Fig. 1 showed a computer response when having missing data in the Web questionnaire form. Moreover, when using the Internet and Web for collecting questionnaire responses, the response data can be collected into computer text files and directly transferred into statistical software, such as SAS or SPSS. Therefore, the data collected from the Internet had no data entry error. In other words, there has been no data entry error occurrence that is based on direct transformation by computers. In this study, the data were collected into a text data file by a CGI (common gateway interface) program that was written by PERL (Practical Extraction and Report Language). The data file was directly transferred from the text file format into SPSS data file format.

Regarding the limitation of questionnaire using the Internet, confidentiality, data safety, computer anxiety, and unstable response rate are all major issues (Igbaria & Parasuraman, 1989; Kuhnert & McMauley, 1996; Nowack, 1997; Stanton, 1998; Weible & Wallace, 1998).

Because of the design of the Web, most documents published there are freely available to anyone who stumbles upon the information with his and her Web browsers. Although access control techniques can overcome this uncontrolled...
situation, such techniques entail time and/or expense associated with customized computer programming. In addition, such techniques also require the distribution of passwords or other access keys to each individual respondent. From an opposite viewpoint, the use of passwords or other access keys creates the potential for evaluating respondents' suspicions about anonymity and confidentiality (Stanton, 1998).

The Internet creates the potential for a powerful communication network; in contrast, it also creates problems of data protection and data safety (Nowack, 1997). To minimize this issue, Nowack (1997) suggested two skills: first, using the Internet as a transportation network; and second, protecting an institution's internal computers against unauthorized access from the Internet. Since the Internet is an open and decentralized network without any central network operator, it is generally impossible to clearly identify Internet users. Based on this point, using the Internet as a tool for transmitting confidential data will improve the safety of data. Furthermore, there have computers, like firewalls, that control the data flow, refuse unauthorized access, and permit authorized access only.

Generally speaking, the users' computer anxiety decreased with more computing experience and high frequency of computer usage (Anderson, 1996; Igbaria & Parasuraman, 1989; Yaghi & Abu-Saba, 1998). Based on this evidence, participants who have less computer-related experience will fear to answer the questionnaire survey with the Internet and Web format. In other words, it may create the statistical issue of restriction of sampling range or skewed distributions because respondents via the Internet may have more computing-related experience.

In general, the response rates from the Internet are from 6 to 70% (Weible & Wallace, 1998). Up to this point, the response rate is unstable, and Weible and Wallace (1998) also indicated that response rates between e-mail and regular mail had no significant differences. But Parker (1992) indicated the response rate from e-mail was almost twice than from mail (68% vs. 38%). It meant that e-mail surveys had a higher response rate when compared with traditional mail.

In this study, respondents' confidence was considered strictly, so respondents' identification statuses were not examined through the use of passwords or other access keys. The respondent data were stored simultaneously into one text data file and one e-mail file for the purpose of data safety. Moreover, the follow-up letter to non-respondents might increase the response rate and might reduce the statistical problem of restriction of range or skewed distribution.

4. Research design

4.1. Research questions

The research questions to be answered by this study are as follows and show as Fig. 2:

Research question 1 (R1). What is the relationship between the CAS and the WAS?
Research question 2 (R2). What are the predictor variables of various computer experiences to the CAS and to the WAS?
Research question 3 (R3). Are there significantly demographic differences on the CAS and on the WAS?

4.2. Instruments

The data for this study was gathered by a questionnaire survey. The questionnaire survey included four major components: (1) demographic information, (2) computer
experience, (3) CAS, and (4) WAS. The questionnaire is described as follow and is presented in the Appendix.

*The demographic information:* the demographic component of the questionnaire covered gender, grade, major of study, and years of computer-related experience. Computer experience: in this component, subjects were asked to indicate whether they had experience using computers, experiences using the Internet/WWW, experience with word processors, experience with database packages, and experience with computer programming languages. These questionnaires are all seven-point likert scales (from “no experience” to “highly experience”).

*CAS:* in this component, subjects were asked to indicate their perceptions toward computer self-efficacy, liking, usefulness, and intention to use and learn computers. These questionnaires were all seven-point likert scales (from “strongly disagree” to “strongly agree”).

*WAS:* in this component, subjects were asked to indicate their perceptions toward Web self-efficacy, liking, usefulness, and intention to use and learn the Web. These questionnaires were all seven-point likert scales (from “strongly disagree” to “strongly agree”).

4.3. Research participants

The participants were students who studied in Seattle Pacific University and were chosen by a Seattle Pacific University’s Web page named “White Pages” for searching students’ email accounts. The method of selection was to use students’ first name as key words for searching. Fifty-eight first names were used in this study for selecting samples and 809 participants were chosen. The participants returned their perceptions by a survey Web page via the Internet. And the total respondents were 263 students. The response rate was 32.5%. Three respondents had no data; therefore, only 260 respondents were conducted by statistical analyses.

4.4. Pretest

The participants of the pretest were doctoral students in the School of Education, Seattle Pacific University. At first, the whole sample size was 33 doctoral students and all of them were in their first or second year of study. The participants returned their surveys from the Web page via the Internet. After responding, the total number of respondents was 20: including 16 female and four male responses. The response rate was 61%.

In this pretest study, the number of the CAS items was 16, the mean (\(M\)) was 96.95, and standard deviation (S.D.) was 11.96. For the split-half coefficient, the scale was split into two halves and these two halves would have equivalent numbers of items. The first half included first eight items and the second half contained last eight items. For the first half, the mean was 47.70 and standard deviation was 7.17. For the second half, the mean was 49.25 and standard deviation was 6.89. Corrected item–total correlations of the first half ranged from 0.31 to 0.78 and of the second
half ranged from 0.32 to 0.82. The alpha coefficient was 0.86 and 0.89 for the first and second half, respectively. Additionally, Cronbach's alpha was 0.90 and the corrected item-total correlations were ranged from 0.31 to 0.82.

The total items of the WAS was 16, the mean (M) was 88.30, and standard deviation (S.D.) was 16.87. For the split-half coefficient, the first half included first eight items and the second half contained last eight items. For the first half, the mean was 42.85 and standard deviation was 9.26. For the second half, the mean was 45.45 and standard deviation was 9.39. Corrected item-total correlations of the first half ranged from 0.20 to 0.82 and of the second half ranged from 0.35 to 0.91. The alpha coefficient was 0.91 and 0.94 for the first and second half, respectively. Furthermore, Cronbach's alpha was 0.94 and corrected item-total correlations were ranged from 0.20 to 0.91.

5. Results

5.1. Internal consistency

The CAS had 16 items, the mean was 94.47, and standard deviation was 13.27. For the split-half coefficient, the first half included first eight items and the second half contained last eight items. For the first half, the mean was 45.99 and standard deviation was 8.26. For the second half, the mean was 48.49 and standard deviation was 6.40. Corrected item-total correlations of the first half were ranged from 0.50 to 0.75 and of the second half were ranged from 0.44 to 0.69. The alpha coefficient was 0.89 and 0.84 for the first and second half, respectively. In addition, Cronbach's alpha of the total instrument was 0.91 and corrected item-total correlations were ranged from 0.44 to 0.75.

The WAS had 16 items, the mean was 91.88, and standard deviation was 14.31. For the split-half coefficient, the first half included the first eight items and the second half contained the last eight items. For the first half, the mean was 45.08 and standard deviation was 7.63. For the second half, the mean was 46.80 and standard deviation was 7.63. Corrected item-total correlations of the first half were ranged from 0.47 to 0.79 and of the second half were ranged from 0.58 to 0.80. The alpha coefficient was 0.87 and 0.91 for the first and second half, respectively. In addition, Cronbach's alpha of the total instrument was 0.93 and corrected item-total correlations were ranged from 0.47 to 0.80.

5.2. Analysis of relationship

The correlation coefficient, $r = 0.81$, $P = 0.000$, presented a positively significant relationship between the CAS ($M = 5.90$, S.D. = 0.83) and the WAS ($M = 5.74$, S.D. = 0.89). This result indicated that there was a high correlation between the perception of computer and Web attitudes. Regarding the relationship between various computer and Web experiences and the CAS, and the WAS, the categories of: experience using computers, experience using the Internet/WWW, experience
with word processors, experience with database packages, experience with computer programming languages, and years of computer-related experience all had significant relationship with the CAS ($P<0.01$) and with the WAS ($P<0.01$). The correlation among various computer experiences, the CAS, and the WAS were presented in Table 1.

5.3. Analysis of prediction

Regarding analytic strategy for assessing the predictive model, path analysis is an appropriate multivariate analytical methodology for empirically examining sets of relationships in the form of linear causal models. In general, the value of the path coefficient associated with each path represents the strength of each linear influence. Although the path coefficient can be estimated in many ways, multiple regression analysis has been used by most empirical applications of this methodology (Lin & Lu, 2000).

A stepwise regression analysis was performed to check the effect of the variables of computer experiences on the CAS. The predictor variables were years of computer-related experience, experience using computers, experience with word processors, experience with database packages, experience with computer programming languages, and experience using the Internet/WWW. The results, Table 2, showed that individual experience using computers, years of computer-related experience, and experience with word processors were three predictors on the CAS ($F(3,256) = 70.50$, $P = 0.000$, $R^2 = 0.45$). A stepwise regression analysis was conducted to check the effect of the variables of computer experiences on the WAS. The predictor variables were as same as those predictor variables on the CAS. The results, Table 3, presented that experience with word processors and experience using the Internet/WWW were two predictors on the WAS ($F(2,257) = 89.94$, $P = 0.000$, $R^2 = 0.41$). The causal relationship was presented in Fig. 3.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Exper2</th>
<th>Exper3</th>
<th>Exper4</th>
<th>Exper5</th>
<th>CAS</th>
<th>WAS</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exper1</td>
<td>0.75**</td>
<td>0.68**</td>
<td>0.56**</td>
<td>0.58**</td>
<td>0.63**</td>
<td>0.54**</td>
<td>0.51**</td>
</tr>
<tr>
<td>Exper2</td>
<td>0.66**</td>
<td>0.51**</td>
<td>0.52**</td>
<td>0.58**</td>
<td>0.59**</td>
<td>0.63**</td>
<td>0.47**</td>
</tr>
<tr>
<td>Exper3</td>
<td>0.47**</td>
<td>0.40**</td>
<td>0.58**</td>
<td>0.51**</td>
<td>0.51**</td>
<td>0.51**</td>
<td>0.41**</td>
</tr>
<tr>
<td>Exper4</td>
<td>0.55**</td>
<td>0.41**</td>
<td>0.40**</td>
<td>0.40**</td>
<td>0.41**</td>
<td>0.30**</td>
<td></td>
</tr>
<tr>
<td>Exper5</td>
<td></td>
<td>0.38**</td>
<td>0.39**</td>
<td>0.39**</td>
<td>0.26**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.81**</td>
<td>0.43**</td>
<td></td>
</tr>
<tr>
<td>WAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.33**</td>
<td></td>
</tr>
</tbody>
</table>

* CAS, Computer Attitude Scale; WAS Web Attitude Scale.

b Exper1, experience using computers, Exper2, experience using the Internet/WWW; Exper3, experience with word processors; Exper4, experience with database packages; and Exper5, experience with computer programming languages; Years, years of computer-related experience.

** Correlation was significant at the 0.01 level ($P<0.01$, two-tailed).
Table 2
Stepwise regression for computer experiences on the CAS*

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience using computers</td>
<td>0.23</td>
<td>0.35</td>
<td>0.000</td>
</tr>
<tr>
<td>Experience with word processors</td>
<td>0.15</td>
<td>0.22</td>
<td>0.001</td>
</tr>
<tr>
<td>Experience using the Internet/WWW</td>
<td>0.11</td>
<td>0.17</td>
<td>0.015</td>
</tr>
</tbody>
</table>

* CAS, Computer Attitude Scale.

Table 3
Stepwise regression for computer experiences on the WAS*

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience with word processors</td>
<td>0.34</td>
<td>0.51</td>
<td>0.000</td>
</tr>
<tr>
<td>Experience using the Internet/WWW</td>
<td>0.12</td>
<td>0.17</td>
<td>0.007</td>
</tr>
</tbody>
</table>

* WAS, Web Attitude Scale.

Essentially, multicollinearity can be controlled by two ways: (1) correlation between independent variables should all less than 0.8 (Emory & Cooper, 1991); (2) variance inflation factors (VIF) should less than 10 (Neter & Kutner, 1990). In this study, multicollinearity was ruled out because the correlation between independent variables, as Table 1 shown, were all less than 0.8 and the VIFs were all less than 10. Based on multiple regression analysis, the scatter plots of the standardized residuals by the standardized predicted scores were also examined to verify the assumption of linearity.

5.4. Analyses of demographic differences

After statistical analysis, there had three significant differences on the CAS and on the WAS that included gender, major of study, and years of computer-related experience.

5.5. Analysis of gender difference

An independent-samples t test was conducted to evaluate the hypothesis that there had been significant gender differences on the CAS and WAS. The results indicated there was a significant difference on the CAS, t(258) = 2.62, P = 0.009, and a significant difference on the WAS, t(258) = 3.42, P = 0.001. These results showed those male students had more positive attitudes toward computers and the Web than female students had. Table 4 presented the means and standard deviations of the CAS and the WAS.
Experience with word processors

.22**

Experience using the Internet/WWW

.17*

Experience using computers

.35**

CAS

.17**

WAS

Fig. 3. Causal relationship among various computer experiences with the Computer Attitude Scale (CAS), and the Web Attitude Scale (WAS). *Correlation was significant at the 0.05 level (P < 0.05, two-tailed). **Correlation was significant at the 0.01 level (P < 0.01, two-tailed).

Table 4
Means and standard deviations of gender on the CAS and the WASa

<table>
<thead>
<tr>
<th>Gender</th>
<th>CAS M</th>
<th>CAS S.D.</th>
<th>WAS M</th>
<th>WAS S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>6.04</td>
<td>0.88</td>
<td>5.94</td>
<td>0.88</td>
</tr>
<tr>
<td>Female</td>
<td>5.78</td>
<td>0.77</td>
<td>5.57</td>
<td>0.88</td>
</tr>
</tbody>
</table>

a CAS, Computer Attitude Scale; WAS, Web Attitude Scale.

5.6. Analysis of difference of major of study

A one-way multivariate analysis of variance (MANOVA) was conducted to determine the effect of major of study (eight different majors) on the two dependent variables, the CAS and the WAS. Significant differences were found among the eight majors on the dependent measures, Wilks' Λ = 0.91, F(14,502) = 1.72, P < 0.05 (P = 0.048). The multivariate η² based on Wilks' Λ was quite strong, 0.46. Analysis of variance (ANOVA) on each dependent variable was conducted as follow-up tests to the MANOVA. Using the Bonferroni method (Green, Salkind, & Akey, 1997), each ANOVA was tested at the 0.025 level. The ANOVA on the CAS was significant, F(7,252) = 2.36, P < 0.025 (P = 0.024), η² = 0.06, and the ANOVA on the WAS also was significant, F(7,252) = 2.75, P < 0.025 (P = 0.009), η² = 0.07.
Table 5
Means and standard deviations of major of study on the CAS and the WAS

<table>
<thead>
<tr>
<th>Major of Study</th>
<th>CAS</th>
<th>WAS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>S.D.</td>
</tr>
<tr>
<td>Fine Arts</td>
<td>5.83</td>
<td>0.88</td>
</tr>
<tr>
<td>Humanities and Religion</td>
<td>5.80</td>
<td>0.83</td>
</tr>
<tr>
<td>Science and Engineering</td>
<td>6.20</td>
<td>0.80</td>
</tr>
<tr>
<td>Social and Behavioral Science</td>
<td>5.61</td>
<td>0.91</td>
</tr>
<tr>
<td>Business and Economics</td>
<td>6.19</td>
<td>0.95</td>
</tr>
<tr>
<td>Education</td>
<td>5.85</td>
<td>0.73</td>
</tr>
<tr>
<td>Health Science</td>
<td>5.70</td>
<td>0.65</td>
</tr>
</tbody>
</table>

CAS, Computer Attitude Scale; WAS, Web Attitude Scale.

Post hoc analyses to the univariate ANOVA consisted of conducting pairwise comparisons to find which major had more positive attitudes on the CAS and the WAS. Each pairwise comparison was tested at 0.003 level (0.025/8). The students who majored in science and engineering had more positive attitudes toward the CAS and the WAS than the students had who majored in social and behavioral science, but the results were not significant, \( P = 0.043 \) on the CAS and \( P = 0.024 \) on the WAS. The means and standard deviations of major of study were presented in Table 5.

5.7. Analysis of difference of years of computer-related experience

In general, the multivariate test for homogeneity of dispersion matrices, or Box’s test, evaluates whether the variances among the dependent variables are the same for all levels of a factor (Green et al., 1997). With conducting MANOVA for examining differences of an independent variable (years of computer-related experience) on dependent variables (the CAS and the WAS), the assumption of homogeneity was violated \( (P = 0.000) \). Based on this violation, a nonparametric procedure was necessary to analyze differences of the independent variable on the dependent variables.

A Kruskal–Wallis test was conducted to evaluate differences among the six levels of years of computer-related experience on median change in the CAS and the WAS. The test, which was corrected for tied ranks, was significant, \( \chi^2 (5, N = 260) = 46.77 \) for the CAS \( (P = 0.000) \) and \( \chi^2 (5, N = 260) = 30.06 \) for the WAS \( (P = 0.000) \). The results indicated significant differences among the independent variable (years of computer-related experience) on the CAS and on the WAS.

Follow-up tests (Mann–Whitney \( U \) tests) were conducted to evaluate pairwise differences among the six groups, controlling for Type I error across tests using the Holm’s sequential Bonferroni approach. The results of these tests indicated significant differences between the level six (6 years or more) and other five levels. The means and standard deviations were shown in Table 6. The follow-up tests of years of computer-related experience on the CAS and the WAS were presented in Table 7.
Table 6
Means and standard deviations of years of computer-related experience on the CAS and the WASa

<table>
<thead>
<tr>
<th>Years of computer-related experience</th>
<th>CAS</th>
<th>WAS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>S.D.</td>
</tr>
<tr>
<td>Level 1 (6 month or less)</td>
<td>5.13</td>
<td>0.89</td>
</tr>
<tr>
<td>Level 2 (6 months to 1 years)</td>
<td>5.07</td>
<td>0.71</td>
</tr>
<tr>
<td>Level 3 (1-2 years)</td>
<td>5.41</td>
<td>1.04</td>
</tr>
<tr>
<td>Level 4 (2-4 years)</td>
<td>5.71</td>
<td>0.89</td>
</tr>
<tr>
<td>Level 5 (4-6 years)</td>
<td>5.93</td>
<td>0.62</td>
</tr>
<tr>
<td>Level 6 (6 or more years)</td>
<td>6.24</td>
<td>0.65</td>
</tr>
<tr>
<td>Average</td>
<td>5.91</td>
<td>0.83</td>
</tr>
</tbody>
</table>

a CAS, Computer Attitude Scale; WAS, Web Attitude Scale.

Table 7
Follow-up tests of years of computer-related experience on the CAS and the WASa

<table>
<thead>
<tr>
<th>Compare two levels</th>
<th>CAS</th>
<th>WAS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mann-Whitney U</td>
<td>P</td>
</tr>
<tr>
<td>Level 6 to Level 1</td>
<td>162.50</td>
<td>0.011</td>
</tr>
<tr>
<td>Level 6 to Level 2</td>
<td>248.50</td>
<td>0.000</td>
</tr>
<tr>
<td>Level 6 to Level 3</td>
<td>716.50</td>
<td>0.001</td>
</tr>
<tr>
<td>Level 6 to Level 4</td>
<td>2141.50</td>
<td>0.001</td>
</tr>
<tr>
<td>Level 6 to Level 5</td>
<td>2158.00</td>
<td>0.035</td>
</tr>
</tbody>
</table>

a CAS, Computer Attitude Scale; WAS, Web Attitude Scale.

6. Discussion

The result of the relationship between the CAS and the WAS indicated that they had a very significantly positive correlation ($r = 0.81$, $P = 0.000$). Based on the result, it could be assumed that the CAS provided a criterion for the concurrent validity of the WAS. Similarly, the WAS also could be assumed as a criterion for the concurrent validity of the CAS. Thus, on the macro view, the result provided the evidence that the CAS could be used as a psychometric questionnaire for surveying individual perceptions toward Web technology. In other words, previous studies of computer attitude scales, such as the CAM developed by Kay or the Computer Attitude Scale developed by Loyd and Loyd, may be available for surveying individuals’ perceptions toward the Web. On the micro view, the finding presented that the CAS and the WAS could highly predict to each other. In other words, the criterion validity of the CWAS was significantly high (Selwyn, 1997).

Regarding prediction, the best two predictor variables for the WAS were experience with word processors and experience using the Internet/WWW. Additionally, the best three predictors for the CAS were experience with word processors, experience using computers, and experience using the Internet/WWW. The results indicated those predictors affected on the WAS were also could influenced on the CAS.
These results supported the CWAS had high criterion validity. These results also generally confirmed researches that based on the CAM, Computer Attitude Scale, and TAM. Based on previous research, users' computer experience would affect their feelings toward computers and the Web. In other words, when users have more computer and Web experiences, they also have more positive attitudes toward computers and the Web.

The results of this study presented male students had more positive perceptions of computers and the Web. Indeed, previous studies (Temple & Lips, 1989; Whitley, 1997) noted that there was a significant gender difference in attitudes toward computers; essentially, male students have more positive feeling and are more likely to learn about computers and the Web than female students do. This study also supported this assumption. Additionally, this study also revealed the difference of major of study. From Table 5, in the CAS, the mean of science and engineering was 6.20 and the mean of social and behavioral science was 5.61. Furthermore, in the WAS, the Table 5 also showed the mean of science and engineering was 6.08 and the mean of social and behavioral science was 5.42. Although statistical analysis could not shown a significant difference between these two majors, it could be assumed that students who majored in science and engineering had more positive attitudes toward computer and Web technologies than those students had who majored in social and behavioral science. Essentially, this study indicated that students who already used computers six or more years had the most positive feeling toward computers and the Web. In other words, when users had more years in computer-related experience, they had more positive perceptions to use computer and Web technologies.

7. Limitations

In conducting the statistical analysis, it was found that respondents were skewed in distribution by the variable of "years of computer-related experience". This might be a crucial limitation of the Internet or WWW survey. This result can support that when individuals have more positive feeling toward computers they have more willing to answer the Internet survey. Generally speaking, the users' computer anxiety decreased with more computing experience and high frequency of using computers (Anderson, 1996; Igbaria & Parasuraman, 1989; Yaghi & Abu-Saba, 1998). Based on this evidence, participants will fear to answer the questionnaire survey with the Internet and Web format when they have low frequency of using computers. In other words, this phenomenon may create the statistical issues of restriction of range or skewed distribution.

Another limitation was the confidence issue. In this study, the responses considered strictly in confidence, so respondents' identification statuses were not examined by use of passwords or other access keys. This is a dilemma. When using access control for each participant, it will create a potential for evaluating respondents' suspicions about anonymity and confidentiality (Stanton, 1998). From an opposite viewpoint, no access control will create duplicating responses by a single respondent.
8. Conclusions

Within the theoretical framework laid out by CAM, TAM, and Computer Attitude Scale, a psychometric scale to measure the students' attitudes towards computers and Web technology has been developed. The CWAS consists of two major components, the CAS and the WAS. Based on highly Cronbach's coefficients $\alpha$, high test-retest reliability, and high concurrent validity between the CAS and the WAS, the CWAS has high internal consistency, stability and validity. In general, the purpose of the CWAS is to understand individual affective, cognitive, and behavioral attitudes toward computers and the Web. Based on high internal consistency, stability and validity, this research has potential for practical application in investigating learners' attitudes when applying computers and the Web for teaching and training. Essentially, understanding learners' perceptions toward information technology is useful and necessary before or during using it as an assisted learning tool.

This study shows that when individuals have more positive attitudes toward computers, then they also have more positive attitudes toward Web environments. Furthermore, like many other studies, prior computer experiences significantly affect individuals' perceptions of computers and Web technologies. A part of this study is an Internet survey, and it is possible that respondents may have had more positive attitudes than non-respondents. Based on this point, the advantages and limitations of Internet or Web surveys should be examined more detail in future research.

Appendix. The survey questionnaire

General and Demographic Information

Gender: Female Male
Grade: Freshman Sophomore Junior Senior Master Doctoral Student
Program of study: Fine Arts, Humanities and Religion, Science and Engineering, Social and Behavioral Sciences, Business and Economics, Education, Health Sciences
Years of computer-related experience: 6 months-, 6 months-1 year, 1-2 years, 2-4 years, 4-6 years, 6 years +
Computer Experience: Question 1-5: (1 = no experience 7 = highly experienced)
1. Experience using computers.
2. Experience using the Internet/World Wide Web (WWW).
3. Experience with any word processors (e.g. Microsoft-Word, WordPad).
4. Experience with any database packages (e.g. Oracle, Microsoft-Access).
5. Experience with any computer programming languages (e.g. C, HTML).

Computer Attitudes Scale (CAS) (1 = strongly disagree 7 = strongly agree)
1. I feel confident using a personal computer.
2. I feel confident using floppy disk to store my data files.
3. I feel confident using word processors (e.g. Microsoft Word, Wordpad).
4. I feel confident learning new computer skills.
5. I like to use computers.
6. I enjoy talking with others about computers.
7. I like to have a computer in my home.
8. I feel comfortable using computer in my daily life.
9. I believe using computer is necessary in my school life.
10. I believe using computers is worthwhile.
11. I use computers multiple ways (e.g. doing word processing, using E-mail, surfing the Web) in my daily life.
12. An increased use of computers can enhance my academic performance.
13. The use of computers is helpful for my studying.
14. The use of computers can increase my job possibilities.
15. I believe that computers can serve as tools for learning.
16. I believe that knowing how to use computers is worthwhile.

Web Attitudes Scale (WAS) (1 = strongly disagree 7 = strongly agree)

1. I feel confident using the Internet/World Wide Web (WWW).
2. I feel confident using E-mail.
3. I feel confident using WWW browsers (e.g. Internet Explorer, Netscape Communicator).
4. I feel confident using search engines (e.g. Yahoo, Excite, and Lycos).
5. I like to use E-mail to communicate with others.
6. I enjoy talking with others about the Internet.
7. I like to work with the Internet/WWW.
8. I like to use the Internet from home.
9. I believe using the Internet/WWW is worthwhile.
10. The Internet/WWW helps me to find information.
11. I believe the Internet makes communication easier.
12. The multimedia environment of WWW (e.g. text, image) is helpful to understand online information.
13. I believe the Internet/WWW has potential as a learning tool.
14. I believe that the Internet/WWW is able to offer online learning activities.
15. I believe that learning how to use the Internet/WWW is worthwhile.
16. Learning the Internet/WWW skills can enhance my academic performance.

References


Are you familiar with other scientific organizations that are active in human rights or may wish to establish a committee? If so, please list them below.

If you would like to post contact information on the website, please list it below.

Please attach a 100-word paragraph summarizing your organization’s activities, Statement of Purpose, and Board resolutions that can be posted on the website. It would also be helpful if you could provide links to information that can be found on your organization’s site.

Thank you for taking the time to fill out this questionnaire!