



PERGAMON

Computers & Education 40 (2003) 343–360

**COMPUTERS &
EDUCATION**

www.elsevier.com/locate/compedu

An empirical investigation of student acceptance of course websites

Hassan M. Selim*

*Department of Business Administration, College of Business & Economics,
United Arab Emirates University, Al Ain PO Box 17555, United Arab Emirates*

Received 22 July 2002; accepted 29 October 2002

Abstract

The World Wide Web (WWW) is the future in teaching and learning. This paper uses the Technology Acceptance Model (TAM) constructs of usefulness and ease of use to assess university students' acceptance of course websites as an effective learning tool. A survey instrument was distributed to 450 undergraduate students and a total of 403 usable responses were obtained. Exploratory and confirmatory factor analyses were implemented using structural equation modeling techniques through LISREL version 8.52. A structural equation model was used to fit and validate the Course Website Acceptance Model (CWAM) and the results indicated good fit to the data. Course website usefulness and ease of use proved to be key determinants of the acceptance and usage of course website as an effective and efficient learning technology. The causal relationships between the constructs considered by the CWAM were well supported, accounting for 83% of the total variance in the course website acceptance and usage.

© 2003 Elsevier Science Ltd. All rights reserved.

Keywords: Improving classroom teaching; Media in education; Teaching/learning strategies; Computer-mediated communication

1. Introduction

In the domain of information technology, the problem of information technology innovation adoption has been discussed using different theoretical formulations and constructs. The main research stream attempts to understand and explain the determinants of the behavior of accepting and using information technology innovation. In 1975, Fishbein and Ajzen developed a well-supported behavioral theory called Theory of Reasoned Action (TRA) that describes the psychological determinants of behavior, as this is shown in Fig. 1, (Fishbein, 1980; Fishbein & Ajzen, 1975, 1977). According to TRA, the immediate determinant of a person's behavior is his/her

* Corresponding author. Fax: +9713-763-2383.

E-mail address: hassan.selim@uaeu.ac.ae (H. M. Selim).

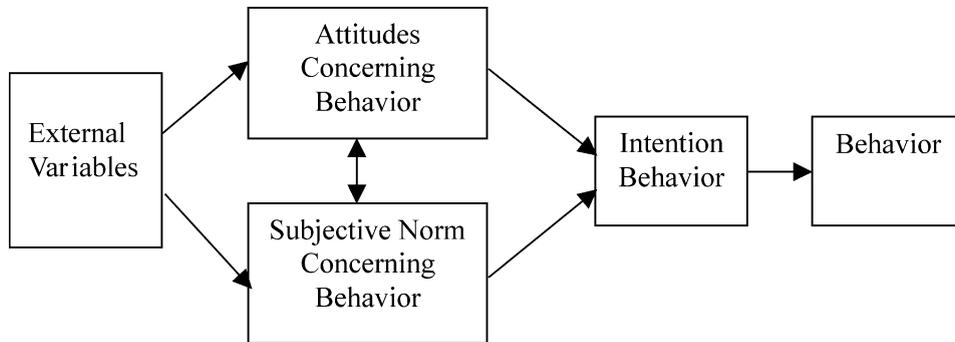


Fig. 1. Fishbein and Ajzen's Theory of Reasoned Action (TRA).

intention to perform the behavior. The person's behavioral intention is in turn said to be determined by his/her attitude concerning the behavior (whether he/she feels that performing the behavior is good or bad) and his/her subjective norm concerning the behavior (whether he/she believes that other individuals want him/her to perform the behavior).

In 1986, Davis proposed an extension of TRA, called the Technology Acceptance Model (TAM), shown in Fig. 2 (Davis, 1986, 1989, 1993). TAM differs from TRA in two aspects. First, TAM introduced two new constructs, perceived usefulness (the belief that using an application will increase one's performance) and perceived ease of use (the belief that one's use of an application will be free of effort). In TAM, both perceived usefulness and perceived ease of use could predict an individual's attitude concerning the use of an application. Second, TAM did not include subjective norm as a determinant of intention. Since its introduction by Davis, TAM has been widely used for predicting the acceptance, adoption, and use of information technologies. Perceived usefulness and perceived ease of use instruments have received substantial attention by researchers both empirically and theoretically (Adams, Nelson, & Todd, 1992; Chin & Gopal, 1995; Hendrickson, Massey, & Cronan, 1993; Igbaria, Guimaraes, & Davies, 1995; Mathieson, 1991; Segars & Grover, 1998; Straub, Limayem, & Karahanna, 1995; Subramanian, 1994). Adams et al. (1992) replicated Davis' work in field studies on the usage of several information technology applications. Hendrickson et al. (1993) examined the test–retest reliability and database software applications.

Venkatesh and Davis (1996) focused on understanding the antecedents of the perceived ease of use. They concluded that computer self-efficacy acts as a determinant of perceived ease of use both before and after hands-on-use and the objective usability was found to be a determinant of ease of

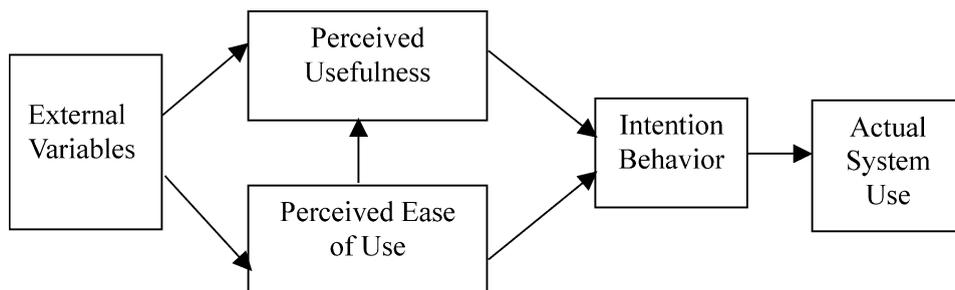


Fig. 2. Davis' Technology Acceptance Model (TAM).

use only after direct experience with a system. They found that users based their ease of use perceptions on computer self-efficacy before hands-on system use. Venkatesh (2001) investigated the determinants of perceived ease of use. Based on a field investigation in three different organizations, strong support was found for the anchoring and adjustment model of determinants. He found that an individual's general beliefs regarding computers were the strongest determinants of system-specific ease of use, even after direct experience with the target system. Venkatesh and Davis (2000) developed and tested a theoretical extension of TAM, referred to as TAM2. TAM2 explains perceived usefulness and usage intentions in terms of social influence (subjective norm, voluntariness, and image) and cognitive instrumental (job relevance, output quality, result demonstrability) processes. In an extension to TAM, Jackson, Chow, and Leitch (1997) developed and tested a model (TAME) which incorporated user involvement (participation in the system development process by potential users or their representatives) and other psychological constructs.

Cross-validation work has focused on communication applications such as email, vmail, and dialup (Adams et al., 1992; Chin & Todd, 1995; Gefen & Straub, 1997; Segars & Grover, 1998; Straub et al., 1995; Subramanian, 1994; Szajna, 1996). Limited cross-validation studies are available for the widely used office-suite applications (Adams et al., 1992; Chau, 1996; Doll, Hendrickson, & Deng, 1998; Hendrickson, 1996; Thompson, 1998). Doll et al. (1998) conducted a confirmatory factor analysis to assess the validity and reliability of the original perceived usefulness and perceived ease of use instruments proposed by Davis. They also conducted a multigroup invariance analysis to assess the equivalence of Davis' instruments across subgroups based on type of application, experience with computing, and gender. This provided a strong support for the validity and reliability of Davis 6-item perceived usefulness and 6-item perceived ease of use instruments. Segars and Grover (1998) questioned the usefulness of Davis' instruments for making comparisons of varying technologies because there are no absolute measures for the constructs. Subramanian (1994) found that the perceived usefulness and ease of use constructs were robust and concluded that information system researchers can use these instruments in varying technological and organizational contexts.

Few studies have investigated TAM as model to explain the use of the WWW. Agrawal and Prasad (1997) focused on individual's perceptions about the characteristics of the target technology as explanatory and predictive variables for acceptance behavior, and presented an empirical study examining the effects of these perceptions on two outcomes (initial use and future use intentions) in the context of innovation represented by the World Wide Web. They concluded that the perceptions that predict the initial use is the same as those that predict future use intentions. They also concluded that voluntariness and external pressures have an impact on the acceptance behavior. Atkinson and Kydd (1997) examined the influence of the individual characteristic of playfulness, ability to use the computer, ease of use, and usefulness on the use of the World Wide Web. They found that all the considered constructs affect World Wide Web use. Fenech (1998) tested Davis' TAM constructs of perceived usefulness and perceived ease of use as predictors of user acceptance of World Wide Web. The results indicated a poor fit for Davis' (1986) TAM model until the inclusion of an additional construct, the computer self-efficacy (Compeau and Higgins, 1995; Igarria and Iivari, 1995; Yi and Venkatesh, 1996). Teo, Lim, and Lai (1999) focused on perceived ease of use, perceived enjoyment, and perceived usefulness for the use of the World Wide Web as TAM was applied in Singapore. Their results were consistent with TAM applications in North America. Lederer, Maupin, Sena, and Zhuang (2000) investigated

TAM with World Wide Web as the application. Their results validated TAM in the context of general World Wide Web acceptance and usage. They provided an understanding of the antecedents to ease of use and usefulness. Seal and Przasnyski (2001) attempted to use the Web beyond simply a means for distribution of class materials. Six feedback forms were administered during a course of a semester. Students in the course indicated that the course websites helped them to understand the course materials better. Seal and Przasnyski's project opened up various possibilities for using course websites for teaching enhancement. They recommended a comprehensive collection of students' responses over multiple semesters to be used for statistical analysis. Lin and Hsieh (2001) reviewed the research evidence on learner control in a web-based teaching environment and the conditions under which it can most effectively facilitate learning. Gal-Ezer and Lupo (2002) concluded that the more advanced the students are in their studies, the more they tend to use the Web in its various applications.

Structural equation modeling techniques have gained increasing popularity in management sciences, notably marketing and organizational behavior, in the last two decades (Chau, 1996). In technology uptake and TAM, several published studies have adopted this approach in order to validate research models and hypotheses. Examples include (Adams et al., 1992; Barki & Hartwick, 1994; Chau, 1996; Chwelos, Benbasat, & Dexter, 2001; Goodhue, Klein, & March, 2000; Hartwick & Barki, 1994; Igarria, & Parasuraman, 1989; Koufaris, 2002; Lederer et al., 2000; Moon & Kim, 2001; Rai, Lang, & Welker, 2002; Straub, Loch, & Hill, 2001; Venkatesh, 2001; Venkatesh & Davis, 2000). As recommended by Segars and Grover (1998), measurement model should be assessed first and "fixed" before the structural equation model is examined. The validity of the measurement model can be validated by confirmatory factor analysis using LISREL. As suggested by Barki and Hartwick (1994), hypothesized paths in the model can then be tested and possible relationships among the model constructs can be explored. Additional models are then assessed to find a "best fitting" model for the study data.

The literature lacks studies that address student use and acceptance of course websites as a teaching and learning tool. There is a need for instructors to investigate how instructional technologies can be integrated and utilized in order to improve and enhance the learning process. An important part of this investigation addresses students' perspectives on the use of course websites in university environment. In this paper, an investigation study is presented to assess the effect of course website usefulness and ease of use on the student acceptance and use of this technology. The objective of this work is to specify the critical factors of course website usefulness and ease of use influencing students' acceptance and use of course websites. The findings of this study will assist instructors to understand the critical factors leading to an effective and efficient adoption of course websites. Based on the discussion presented in this section, the next section tests and validates the course website acceptance research model.

2. Research model and method

2.1. Research model and hypotheses

Fig. 3 shows the Course Website Acceptance Model (CWAM) used to investigate course website acceptance by university students. Similar to previous research, three constructs were used:

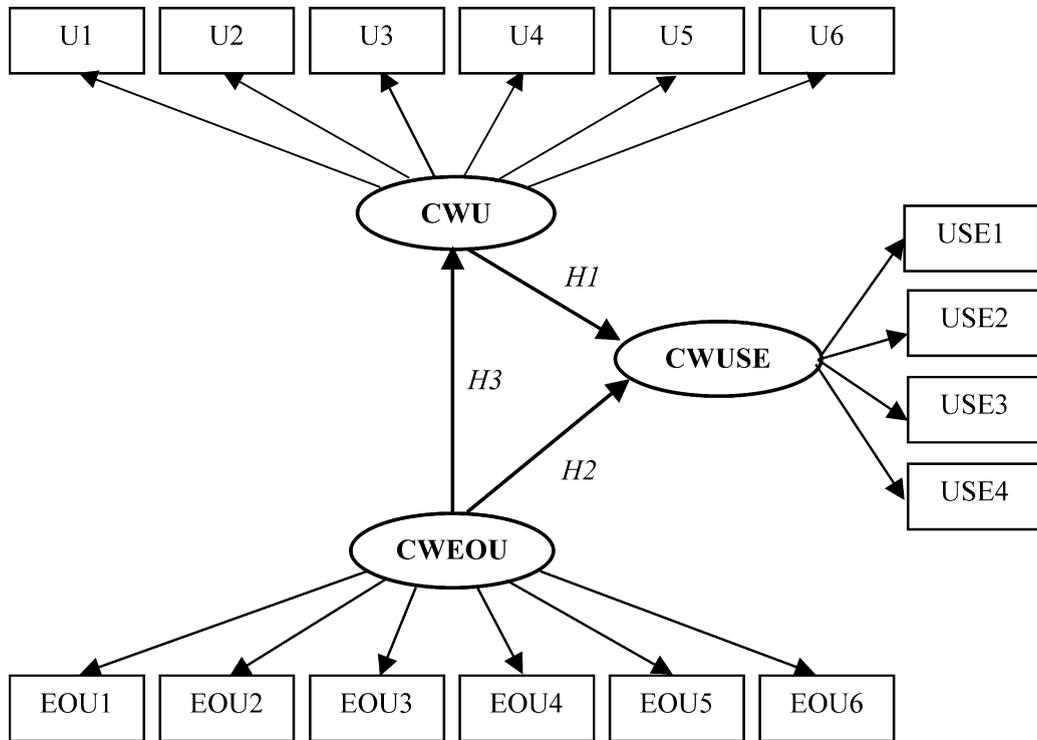


Fig. 3. Course Website Acceptance Model.

ease of use, usefulness, and usage as an acceptance indicator (Agrawal & Prasad, 1997; Atkinson & Kydd, 1997; Fenech, 1998; Lederer et al., 2000; Moon & Kim, 2001; Teo et al. 1999; Venkatesh, 2001). Both the course website usefulness (CWU) and ease of use (CWEOU) were measured by six indicators; course website usage (CWUSE) was measured using four indicators. CWU is defined as “the students’ belief that using course websites will increase their learning performance, efficiency, and effectiveness” (Davis, 1986; Venkatesh, 2001; Venkatesh and Davis, 2000). CWEOU refers to “the degree to which the user expects the use of the course websites to be free of effort” (Davis, 1989; Teo et al., 1999). CWUSE is the intention to use the course website which is used as an indicator to the acceptance of course websites. Students will accept course websites as a learning and teaching support technology if they perceive that this technology would help them to improve their learning effectiveness and efficiency. On the other hand, educational institutions will adopt course websites if they perceive its usefulness. Numerous empirical studies have already validated the relationship between usefulness and user acceptance and between ease of use and user acceptance of information technologies (Chin & Todd, 1995; Davis & Venkatesh, 1995; Gefen & Keil, 1998a, 1998b; Subramanian, 1994; Szajna, 1996; Thompson & Rose, 1994).

According to CWAM which is TAM applied to the course website technology, the basic TAM hypotheses are to be verified. The first hypothesis tests the relationship between usefulness and usage. The more useful the students perceive the course websites, the more acceptable the course websites are perceived to be. Accordingly, the following hypothesis is proposed:

H₁. Usefulness is important in predicting the course websites usage. Course website usefulness positively impact its usage.

The more easy to use the course website, the more it is accepted and used. The [second hypothesis](#) tests the relationship between ease of use and website acceptance and usage. The ease of use is postulated to impact the course website usefulness. Accordingly, the second hypothesis is proposed.

H₂. Course website usage will significantly and positively associated with its ease of use.

The [third hypothesis](#) tests the relationship between course website ease of use and usefulness. The ease of use is postulated to impact the course website usefulness. Accordingly, the following hypothesis is proposed.

H₃. The course website ease of use significantly impacts its usefulness.

2.2. Subjects

The subjects participated in this study included a total of 450 undergraduate students. All participants volunteered to participate in the study and the sample was random in time, a total of 403 responded representing 89.6% response rate. Females and males comprise 69 and 31%, of the respondents, respectively. The students were enrolled in 18 sections of 10 different courses at the AACSB accredited College of Business and Economics at the United Arab Emirates University (UAEU). [Table 1](#) summarizes the demographic profile and descriptive statistics of the respondents. Subject ages ranged from 19 to 26 years, with a mean of 21.3 years and standard deviation of 1.2 years. Most of the respondents were in the 21–22 years old group. Participants came from nine different countries, mostly from the Middle East. Students have an average Grade Point Average (GPA) of 2.94 with a standard deviation of 0.49. Participants had eight majors, namely Accounting, Economics, Finance and Banking, General Business, Management, Management Information Systems, Marketing, and Statistics. The Internet experience of the respondents varies from 1 to 8 years, 68.5% had between 1 and 3 years of experience, and 84.1% of the respondents had from 1 to 2 years experience with course websites.

2.3. Instrument

Based on the CWAM research model, a survey instrument for assessing acceptance of course websites technology in teaching and learning was developed. The survey instrument consisted of 27 items, 11 in the first section and 16 in the second section. The first 11 items of the survey instrument assessed demographic characteristics such as age, gender, nationality, major, GPA, Internet experience, course websites experience, and the Web browser used in surfing the Web. The 16 items in the second section assessed the three constructs of CWAM. [Appendix](#) lists the 16 items of the survey instrument. All the 16 items used a seven-point Lickert scale with 1 representing exceptionally disagree and 7 representing exceptionally agree. The items used to measure CWU, CWEOU, and CWUSE were adopted from previous research ([Davis, 1989](#); [Igbaria, Iivari,](#)

Table 1
Descriptive statistics and demographic profile of the respondents

Item		Frequency	Percent
Gender	Male	124	31.0
	Female	279	69.0
Age	19–20	95	23.5
	21–22	261	64.8
	23–24	37	9.2
	25–26	10	2.5
Years at university	1–3	119	29.5
	3–6	276	68.5
	6–8	8	2.0
Internet access	Yes	325	80.6
	No	78	19.4
Years of internet experience	1–3	276	68.5
	3–6	121	30.0
	6–8	6	1.5
Years of course web use	1	211	52.3
	2	128	31.8
	3	44	10.9
	> 3	20	5.0
Web browser	Netscape	28	7.0
	Explorer	229	56.8
	Both	127	31.5
	Other	19	4.7

& Maragahh, 1995; Moon & Kim, 2001; Teo et al., 1999; Venkatesh, 2001; Venkatesh & Davis, 2000).

Six items assessed the extent of course websites usefulness (CWU) as perceived by students. All the six items were adopted from TAM model's usefulness construct which is validated by (Davis, 1989; Moon & Kim, 2001; Venkatesh, 2001; Venkatesh & Davis, 1994). Students were asked to rate the items according to how they feel about the course website usefulness. The item statements are given in Appendix as U1–U6. Six indicators of course website ease of use (CWEOU) were adopted from (Davis, 1989; Moon & Kim, 2001). The items are given in Appendix A as EOU1–EOU6. The students were asked to indicate their agreement or disagreement with the six EOU items using a seven-point Likert scale. Four indicators were used to assess course websites usage (CWUSE). The four indicators were adopted from the original TAM's EOU construct by (Davis, 1986) and given in Appendix as USE1–USE4. All the adopted indicators were refined to suite the CWAM and assess the critical antecedents of the three constructs.

Five college instructors who actively used websites in their teaching and a random sample of 50 undergraduate students participated in the instrument pre-testing. Minor changes to the order and

wording of the items resulted from the pre-testers feedbacks. Survey instruments were distributed during lectures and left to the students to be filled and returned later. About 89.6% of the students completed the survey instrument. The students were informed that all the data were anonymous and were to be used in assessing the acceptance of course websites technology in the university instruction environment. The mean and standard deviation of each item are presented in Table 2.

2.4. Instrument reliability and validity

Exploratory factor analysis (EFA) was used to detect and assess sources of variation and covariation in observed measurements (Joreskog, Sorbom, du Toit, & du Toit, 2000). The EFA was carried out using the three constructs CWEOU, CWU, and CWUSE. Table 3 shows LISREL version 8.52 output results for the Promax-rotated factor loadings. Items intended to measure the same construct demonstrated markedly higher factor loadings (>0.50) and are shown in bold in Table 3. This testifies to the validity of the survey instrument for further analysis.

Research instrument reliability is often estimated by Chronbach's alpha (α). Table 2 shows the α values for the three constructs of the CWAM research model. Hair, Anderson, Tatham, and Black (1998) suggested that the acceptable value of α is at least 0.70. As shown in Table 2, all constructs exhibit a high degree of internal consistency as the α values of the constructs are greater than 0.90. It was concluded that the indicators could be applied for the analysis with acceptable reliability.

The average variance extracted, reflects the overall amount of variance in the indicators accounted for by the latent construct. The average variance extracted is more conservative than Chronbach's alpha (α) as a composite reliability measure and its accepted value is 0.50 or above for a construct (Fornell & Larcker, 1981). As shown in the last column of Table 2 all the extracted

Table 2
Reliability of CWAM items

Construct	Item	Mean	Standard deviation	α	Variance extracted
CWEOU	EOU1	6.238	1.016	0.9115	0.6
	EOU2	6.275	0.947		
	EOU3	6.141	1.043		
	EOU4	6.062	0.930		
	EOU5	6.067	0.999		
	EOU6	6.238	1.066		
CWU	U1	6.124	1.174	0.9101	0.5
	U2	5.938	1.152		
	U3	6.020	1.167		
	U4	5.514	0.968		
	U5	5.911	1.132		
	U6	6.030	1.126		
CWUSE	USE1	5.655	0.966	0.9094	0.5
	USE2	5.715	1.077		
	USE3	5.623	1.016		
	USE4	5.705	1.029		

Table 3
Exploratory factor analysis for the survey instrument validity

Item	CWEOU	CWU	CWUSE
EOU1	0.716	−0.127	0.207
EOU2	0.779	0.011	0.116
EOU3	0.722	0.233	−0.153
EOU4	0.686	0.135	−0.015
EOU5	0.895	0.019	−0.115
EOU6	0.845	−0.036	0.120
U1	0.038	0.607	0.127
U2	0.018	0.691	0.039
U3	0.077	0.629	0.162
U4	−0.001	0.642	0.104
U5	−0.071	0.835	0.088
U6	0.134	0.751	−0.136
USE1	0.005	0.070	0.812
USE2	0.023	0.251	0.602
USE3	0.046	−0.004	0.873
USE4	−0.039	0.245	0.538

Bold values represent factor loadings > 0.5.

variances are greater than or equal to 0.50. Average variance extracted can be used to evaluate discriminant validity. The square root of average variance extracted for each construct should be greater than the correlations between that construct and all other constructs (Fornell & Larcker, 1981). Table 4 shows the correlation matrix of the constructs and the square root of average variance extracted. The discriminant validity assessment does not reveal any problems. EFA, Chronbach's alpha, and average variance extracted concluded that the used survey instrument is reliable and valid. In the next section, CWAM and measurement models are tested.

3. Testing the course website acceptance model

LISREL confirmatory factor analysis (CFA) was used to examine the three measurement models associated with the course website usefulness, ease of use, usage and to examine the full CWAM. The goodness of fit of all the four models was also evaluated. As mentioned by Chau (1996), there is a number of measures generated by LISREL to evaluate the goodness of fit of the

Table 4
Correlation matrix of the constructs

Construct	CWEOU	CWU	CWUSE
CWEOU	0.78*		
CWU	0.56	0.71*	
CWUSE	0.44	0.63	0.71*

* Square roots of the average variance extracted.

research model. The most popular index is perhaps the chi-square (χ^2) statistic. This statistic tests the proposed model against the general alternative in which all observed variables are correlated (in LISREL terms, unconstrained). With this index, significant values indicate poor model fit while insignificant values indicate good fit. This is why it is also called a “badness-of-fit” measure. Hartwick and Barki (1994) used four other measures of overall model goodness of fit: chi-square/degrees of freedom ratio, Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Average Absolute Standardized Residual (AASR). In another study, Segars and Grover (1993) included several other measures of model fit: Goodness-of-fit Index (GFI), Adjusted Goodness-of-fit Index (AGFI), Pit Criterion, and Root Mean Square Residual. Table 5 lists the recommended values of various measures of model fit as suggested by Segars and Grover (1993) and readapted by Chau (1996). Poor goodness-of-model-fit indicates possible model misspecifications. Two parts of the LISREL output, standardized residuals and modification indices, can be used to help determine possible sources of the lack of fit.

3.1. Examination of CWAM measurement models

As suggested by (Segars & Grover, 1993), before fitting the CWAM, confirmatory factor analysis (CFA) was used to examine the three measurement models associated with the course website usefulness, ease of use, and usage. The measurement model of CWEOU construct is shown in Fig. 4. This measurement model yielded a chi-square (χ^2) statistic of 15.17 and a P -value of 0.09, which suggested good model fit. Fig. 4 shows the estimated path coefficients, as well as the associated t -value for each item. The t -values on significant paths are shown in bold. Table 5 shows summary of the model fit measures which are all within acceptable limits. All the six items were significant at $P < 0.0001$. This indicates that all the considered items are critical to the course website ease of use and should be considered by course website developers namely, the ease with which students learn how to use the course website, the flexibility of interacting with the website, the ease with which students can get information from the course website, and the clearness and understandability of interacting with the course website.

Table 5
Fit measures for measurement models

Fit measure	CWEOU model	CWU model	CWUSE model	CWAM model	Recommended values
Chi-square (χ^2)	15.17	7.75	0.27	119.00	–
P -value	0.09	0.26	0.60	0.06	≥ 0.05
Degrees of Freedom	9	6	1	97.00	–
χ^2 /Degree of freedom (DF)	1.69	1.29	0.27	1.23	≤ 3.0
Root Mean Square Residual (RMR)	0.047	0.024	0.004	0.10	≤ 0.10
Goodness-of-Fit Index (GFI)	1.00	1.00	1.00	0.99	≥ 0.90
Adjusted Goodness-of-Fit Index (AGFI)	0.99	0.99	1.00	0.98	≥ 0.80
Normed Fit Index (NFI)	0.98	0.98	1.00	0.97	≥ 0.90
Nonnormed Fit Index (NNFI)	0.99	0.99	1.00	0.99	≥ 0.90
Comparative Fit Index (CFI)	0.99	1.00	1.00	1.00	≥ 0.90
Root Mean Square Error of Approximation (RMSEA)	0.041	0.027	0.00	0.024	≥ 0.10

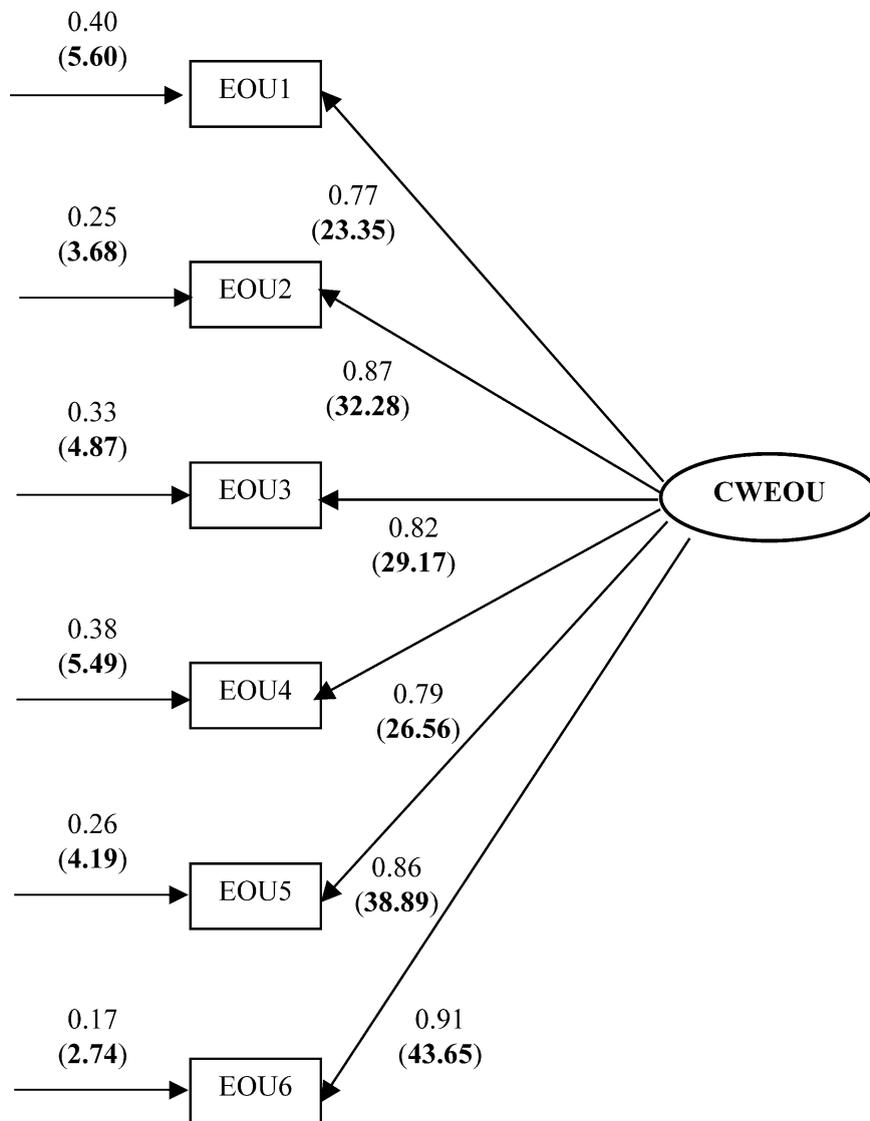


Fig. 4. Measurement model of CWEOU.

The measurement model of CWU construct was examined and shown in Fig. 5. A summary of the model fit measures observed for the measurement model is given in Table 5. As compared to the recommended values, all fit measures surpassed the acceptable levels suggesting a good fit. All the six items used to indicate the course website usefulness as perceived by students were significant at $P < 0.0001$. Accordingly the critical usefulness factors are the effects of the course website on the quality of course work, and on student efficiency and effectiveness in accomplishing the course tasks.

The latent variable CWUSE measurement model was examined and yielded good model fit measures (see Table 5). Fig. 6 shows the estimated path coefficients and the associated t -values.

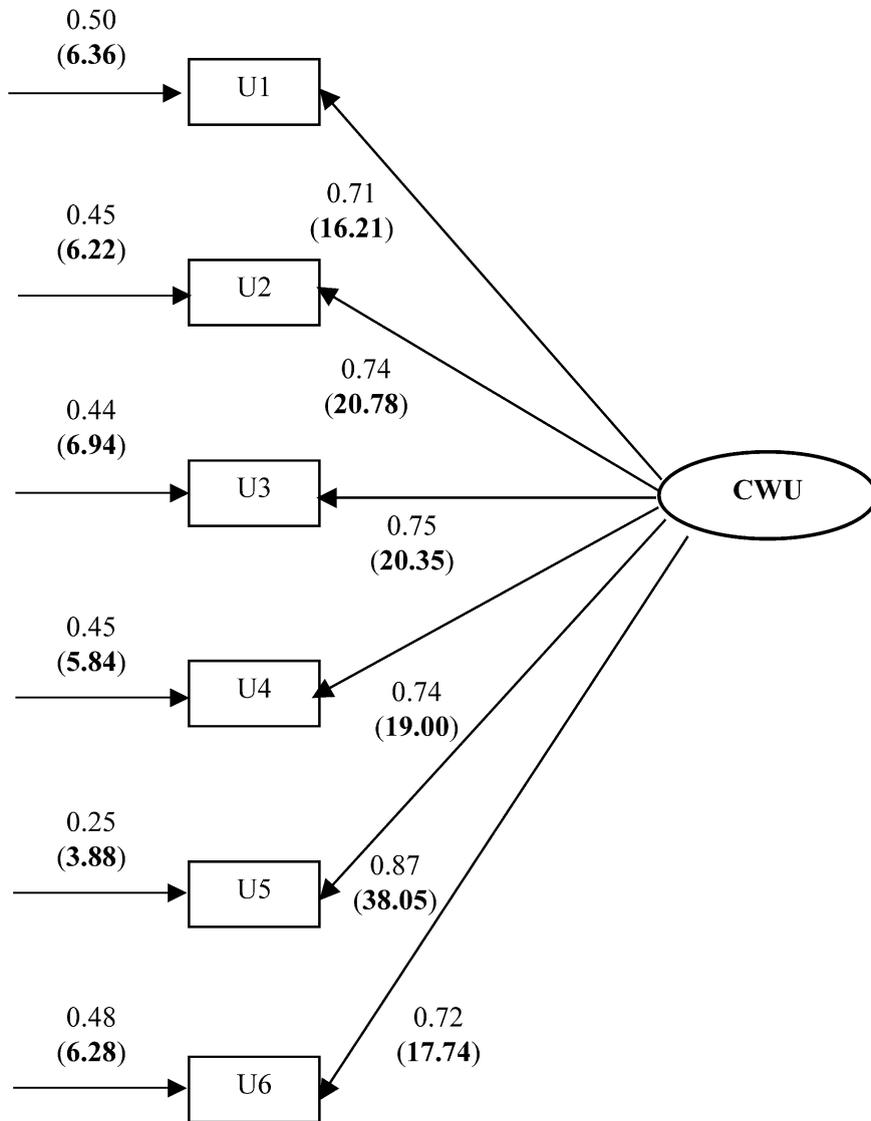


Fig. 5. Measurement model of CWU.

All used items were significant at $P < 0.0001$ indicating that students use the course website a lot or on frequent basis if they perceive its usefulness and ease of use. The tested measurement models were inline with previous research used to validate similar indicators and constructs.

3.2. Examination of CWAM model

The CWAM (illustrated in Fig. 3) was tested using CFA in LISREL version 8.52. The objective was to test the three hypotheses and the research model fit. The CWAM model was evaluated for

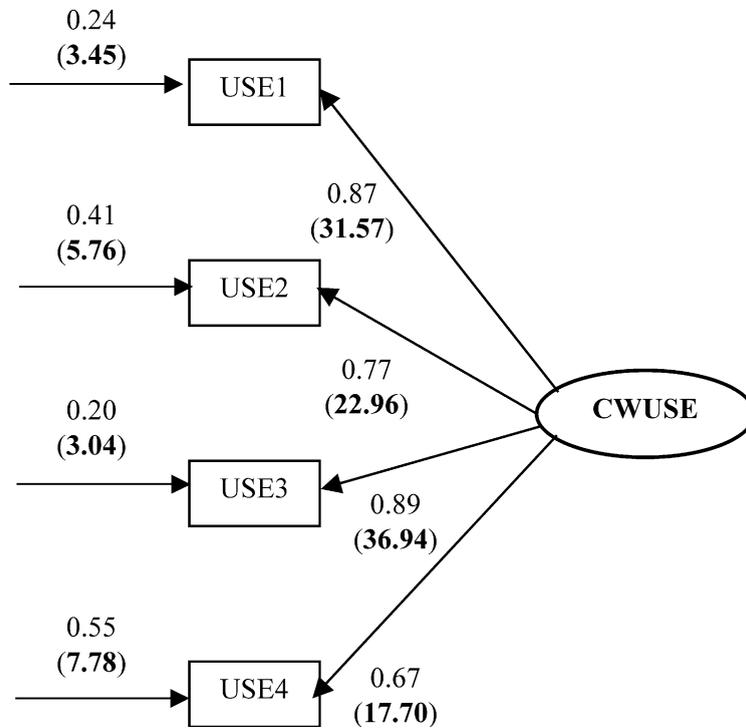


Fig. 6. Measurement model of CWUSE.

its validity using the asymptotic covariance matrix. The asymptotic covariance matrix and the weighted least squares method were used because all the indicator variables were ordinal (Joreskog & Sorbom, 1996; Joreskog et al., 2000). The modification indices suggested by LISREL were taken into consideration and the standardized residuals were checked. A summary of the model fit measures is given in Table 5. The χ^2 statistic indicates that the model fits the data ($\chi^2 = 119.00, P = 0.06 > 0.05$). The ratio (χ^2/DF) is 1.23, which is below the desired value of 3.0 as recommended by the research literature (Chau, 1996; Segars & Grover, 1998). The GFI and AGFI values are 0.99 and 0.98, respectively indicating a good fit. Further, RMR (0.10), NFI (0.97), NNFI (0.99), CFI (1.00), and RMSEA (0.024) are all within the acceptable levels. The

Table 6
Direct, indirect, and total effect on constructs

Hypothesis	Path	Direct		Indirect effect		Total effect (t-value)	Result
		Effect (t-value)	%	Effect (t-value)	%		
H ₁	CWU → CWUSE	0.84* (13.14)	100			0.84* (13.14)	Accepted
H ₂	CWEOU → CWUSE	0.09 (1.34)	12	0.66* (11.19)	88	0.75* (16.65)	Accepted
H ₃	CWEOU → CWU	0.78* (19.34)	100			0.78* (19.34)	Accepted

* $P < 0.0001$.

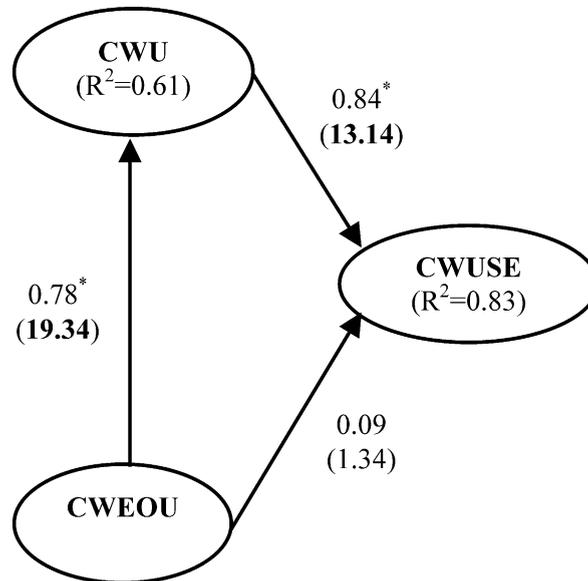


Fig. 7. CWAM structural equation model.

estimated parameters and the corresponding t -values of the final research model appear in Table 6 and Fig. 7. As illustrated in Fig. 7, the results indicate that the explained variance of CWU is 0.61. The CWAM as a whole explains 0.83 of the variance in course website acceptance.

As illustrated in Fig. 7 and Table 6, the direct path CWU→CWUSE is significant since the regression coefficient (β) is 0.84 with t -value of 13.14 and $P < 0.0001$. Therefore, the hypothesis H_1 is supported, which means that course website usefulness (CWU) significantly predicts the acceptance and usage of course websites. Although the path CWEOU→CWUSE has insignificant direct effect on the usage and acceptance, it has a significant indirect effect that represents 88% of the total effect, as shown in Table 6. The total effect of the course website ease of use (CWEOU on the course website usage and acceptance (CWUSE) is significant with β of 0.75, t -value of 16.65 and P -value < 0.0001 which supports H_2 . The third hypothesis H_3 is also accepted because the direct path CWEOU→CWU is significant with β of 0.78, t -value of 19.34, and $P < 0.0001$.

The results showed that CWU exhibited the highest direct impact on course website acceptance whereas the course website ease of use had a less direct effect on course website acceptance, mediated through CWU. The results of testing the three hypotheses support TAM propositions published before (Atkinson & Kydd, 1997; Lederer et al. 2000; Moon & Kim, 2001; Teo et al. 1999).

4. Discussion and conclusions

The purpose of this study was to investigate the acceptance of course websites as teaching and learning tool in higher education institutions as perceived by university students and specify the critical factors contributing to the course website usefulness, ease of use, and usage. LISREL was

used to validate and test the relationships between course website usefulness and ease of use constructs against the course website usage as an indicator of its acceptance. The causal relationships between the constructs were well supported. The CWAM analysis indicated that course website usefulness has significant direct impact on the course website acceptance. Ease of use significantly affects the students' usefulness directly and course website acceptance indirectly through the mediating construct CWU.

The findings of this study have significant implications on the appropriateness of relying on course websites. Instructors and higher education institutions should focus on the course websites usefulness and ease of use as indicated by factors given in [Appendix](#) because they form the highest predictive effect on the course website acceptance and usage.

This study revealed four major critical factors for the perceived usefulness of course websites. The first of these is the course work interactivity. There are several Web-based tools that can be used to improve course work interactivity. For example, asynchronously delivered course material allows students to retain control as to when and where they engage in the instruction. Electronic discussion forum is another course work quality improvement tool that enhances communications and interaction among students. Course materials could be available electronically in different formats via the course website and students can freely download any of them. Course website should include links to related materials and websites that widen the students exposure to current information on their topics.

Another critical course website usefulness factor is to enable students to accomplish their course work quickly by providing them with on-line components such as animations and multimedia modules. The third factor is to make studying course material easier by having the course material available anytime anywhere, facilitating student–student and student–instructor communications, and using interactive tools to explain course content. The last critical factor is to increase the students' productivity and effectiveness. This critical factor is a result of enabling students to finish their course work quickly and achieving their objectives efficiently using the tools available on the course website.

As a result of analyzing CWEOU, critical determinants of course website ease of use can be grouped into three features: consistency, flexibility and efficiency of use, and understandability. Course website consistency can be achieved by using similar concepts, terminology, graphics, layout, and navigational structure. All these features lead to minimum learning needed to use the course website. Course website flexibility and efficiency of use are achieved by accommodating a range of user sophistication and diverse goals. Course website understandability is the use of relevant and focused information. It is preferred to use short documents with one topic ideally on a single page and organize information hierarchically with general information before specific details.

In line with previous studies, TAM published conclusions have been confirmed and validated as applied to course website acceptance and usage by students ([Davis, 1986](#); [Venkatesh, 2001](#)). The concluded critical success factors validated the list provided by [Seal and Przasnyski \(2001\)](#).

Acknowledgements

My thanks and appreciation to my colleague Professor Yahia El Bassiouni, for his valuable comments. The support of all the students involved in this research is gratefully acknowledged.

Appendix: Course website acceptance questions by construct

CWU

- U1 Using the course website improves the quality of the course work I do
- U2 Using the course website enables me to accomplish course tasks more quickly
- U3 Using the course website makes it easier to study the course material
- U4 Using the course website increases my productivity
- U5 Using the course website enhances my effectiveness in the coursework
- U6 I find the course website useful in the course work

CWEOU

- EOU1 Using the course website is easy for me
- EOU2 It was easy for me to become skillful at using the course website
- EOU3 I find the course website easy to use
- EOU4 I find the course website to be flexible to interact with
- EOU5 My interaction with the course website is clear and understandable
- EOU6 I find it easy to get the information I want from the course website

CWUSE

- USE1 I use the course website a lot to do my course work
- USE2 I use the course website whenever possible to do my course work
- USE3 I use the course website frequently to do my course work
- USE4 I use the course website whenever appropriate to do my course work

References

- Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: a replication. *MIS Quarterly*, *16*, 227–248.
- Agrawal, R., & Prasad, J. (1997). The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. *Decisions Sciences Journal*, *28*, 557–582.
- Atkinson, M., & Kydd, C. (1997). Individual characteristics associated with World Wide Web use: an empirical study of playfulness and motivation. *The Data Base for Advances in Information Systems*, *28*(2), 53–62.
- Barki, H., & Hartwick, J. (1994). Measuring user participation, user involvement, and attitude. *MIS Quarterly*, *18*(1), 59–82.
- Chau, P. Y. K. (1996). An empirical assessment of a modified technology acceptance model. *Journal of Management Information Systems*, *13*, 185–204.
- Chin, W. W., & Gopal, A. (1995). Adoption intention in GSS: relative importance of beliefs. *DATA BASE for Advances in Information Systems*, *26*, 42–64.
- Chin, W. W., & Todd, P. A. (1995). On the use, usefulness, and ease of use of structural equation modeling in MIS research: a note of caution. *MIS Quarterly*, *19*(2), 237–246.
- Chwelos, P., Benbasat, I., & Dexter, A. S. (2001). Empirical test of an EDI adoption model. *Information Systems Research*, *12*(3), 304–321.
- Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: development of a measure and initial test. *MIS Quarterly*, *19*, 189–211.

- Davis, F. D. (1986). *Technology acceptance model for empirically testing new end-user information systems: theory and results*. MA, USA: Massachusetts Institute of Technology.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly*, 13, 319–340.
- Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, 38, 475–487.
- Davis, F. D., & Venkatesh, V. (1995). Measuring user acceptance of emerging information technologies: an assessment of possible method biases. *Proceedings of the 28th Annual Hawaii International Conference on Systems Sciences*, 729–736.
- Doll, W. J., Hendrickson, A., & Deng, X. (1998). Using Davis's perceived usefulness and ease-of-use instruments for decision making: a confirmatory and multigroup invariance analysis. *Decision Sciences*, 29, 839–869.
- Fenech, T. (1998). Using perceived ease of use and perceived usefulness to predict acceptance of the World Wide Web. *Computer Networks*, 30, 629–630.
- Fishbein, M. (1980). *A theory of reasoned action: some applications and implementations*. Lincoln, NB, USA: University of Nebraska Press.
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: an introduction to theory and research*. Reading, MA: Addison-Wesley Publishing Company.
- Fishbein, M., & Ajzen, I. (1977). Attitudes and openions. *Annual review of Psychology*, 23, 487–544.
- Fornell, C., & Larcker, D. (1981). Evaluating structural equation models with unobservable variable and measurement error. *Journal of Marketing Research*, 18, 39–50.
- Gal-Ezer, J., & Lupo, D. (2002). Integrating Internet tools into traditional CS distance education: students' attitudes. *Computers & Education*, 38(4), 319–329.
- Gefen, D., & Keil, M. (1998a). The impact of developer responsiveness on perception of usefulness and ease of use: an extension of the technology acceptance model. *The Data Base for Advances in Information Systems*, 29(2), 35–49.
- Gefen, D., & Keil, M. (1998b). The impact of developer responsiveness on perceptions of usefulness and ease of use: an extension of the technology of the technology acceptance model. *DATA BASE for Advances in Information Systems*, 29, 35–49.
- Gefen, D., & Straub, D. (1997). Gender differences in perception and adoption of e-mail: an extension to the technology acceptance model. *MIS Quarterly*, 21, 389–400.
- Goodhue, D. L., Klein, B. D., & March, S. T. (2000). User evaluations of IS as surrogates for objective performance. *Information & Management*, 38, 87–101.
- Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). *Multivariate data analysis* (5th ed.). New York: Prentice Hall.
- Hartwick, J., & Barki, H. (1994). Explaining the role of user participation in information system use. *Management Science*, 40, 440–465.
- Hendrickson, A. R. C. M.R. (1996). An assessment of structure and causation of IS usage. *DATA BASE for Advances in Information Systems*, 27, 61–67.
- Hendrickson, A. R., Massey, P. D., & Cronan, T. P. (1993). On the test–retest reliability of perceived usefulness and perceived ease of use scales. *MIS Quarterly*, 17, 227–230.
- Igbaria, M., Guimaraes, T., & Davis, G. B. (1995). Testing the determinants of microcomputer usage via a structural equation model. *Journal of Management Information Systems*, 11(4), 87–114.
- Igbaria, M., & Iivari, J. (1995). The effects of self-efficacy on computer usage. *OMEGA, The International Journal of Management Science*, 23(6), 587–605.
- Igbaria, M., Iivari, J., & Maragahh, H. (1995). Why do individuals use computer technology? A Finnish case study. *Information & Management*, 29(5), 227–238.
- Igbaria, M., & Parasuraman, S. (1989). A path analytic study of individual characteristics, computer anxiety, and attitudes towards microcomputers. *Journal of Management*, 15, 373–388.
- Jackson, C. M., Chow, S., & Leitch, R. A. (1997). Toward an understanding of the behavioral intention to use an information system. *Decisions Sciences Journal*, 28, 357–389.
- Joreskog, K., & Sorbom, D. (1996). *LISREL 8: user's reference guide*. Chicago, USA: Scientific Software International.

- Joreskog, K., Sorbom, D., du Toit, S., & du Toit, M. (2000). *LISREL 8: new statistical features*. Chicago, USA: Scientific Software International.
- Koufaris, M. (2002). Applying the technology acceptance model and flow theory to online consumer behavior. *Information Systems Research*, 13(2), 205–223.
- Lederer, A. L., Maupin, D. J., Sena, M. P., & Zhuang, Y. (2000). The technology acceptance model and the World Wide Web. *Decision Support Systems*, 29(3), 269–282.
- Lin, B., & Hsieh, C. (2001). Web-based teaching and learner control: a research review. *Computers & Education*, 37(3–4), 377–386.
- Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research*, 2, 173–191.
- Moon, J., & Kim, Y. (2001). Extending the TAM for a World-Wide-Web context. *Information & Management*, 38(4), 217–230.
- Rai, A., Lang, S., & Welker, R. (2002). Assessing the validity of IS success models: an empirical test and theoretical analysis. *Information Systems Research*, 13(1), 50–69.
- Seal, K. C., & Przasnyski, Z. H. (2001). Using the World Wide Web for teaching improvement. *Computers & Education*, 36(1), 33–40.
- Segars, A. H., & Grover, V. (1993). Re-examining perceived ease of use and usefulness: a confirmatory factor analysis. *MIS Quarterly*, 17, 517–525.
- Segars, A. H., & Grover, V. (1998). Strategic information systems planning success: an investigation of the construct and its measurement. *MIS Quarterly*, 22, 139–163.
- Straub, D., Limayem, M., & Karahanna, E. (1995). Measuring system usage: implications for IS theory testing. *Management Science*, 41, 1328–1342.
- Straub, D., Loch, K., & Hill, C. (2001). Transfer of information technology to the Arab World: a test of cultural influence modeling. *Journal of Global Information Management*, 9(4), 7–28.
- Subramanian, G. H. (1994). A replication of perceived usefulness and perceived ease of use. *Decisions Sciences Journal*, 25, 863–874.
- Szajna, B. (1996). Empirical evaluation of the revised technology acceptance model. *Management Science*, 42, 85–92.
- Teo, T. S. H., Lim, V. K. G., & Lai, R. Y. C. (1999). Intrinsic and extrinsic motivation in internet usage. *OMEGA, The International Journal of Management Science*, 27(1), 25–37.
- Thompson, R. (1998). *Extending the technology acceptance model with motivation and social factors* (pp. 757–759). Association for Information Systems Annual Conference.
- Thompson, R., & Rose, G. (1994). *Information Technology adoption and use* (pp. 16–26). The Administration Sciences Association of Canada (ASAC) Annual Conference.
- Venkatesh, V. (2001). Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research*, 11(4), 342–365.
- Venkatesh, V., & Davis, F. D. (1994). Modeling the determinants of perceived ease of use. *Fifteenth International Conference on Information Systems*, 213–227.
- Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: development and test. *Decision Sciences*, 27, 451–481.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, 46, 186–204.
- Yi, M. Y., & Venkatesh, V. (1996). Role of computer self-efficacy in predicting user acceptance and use of information technology. In *Second Americas Conference on Information Systems—Association for Information Systems*.