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Abstract

Purpose – The primary purpose of this paper is to integrate unified theory of acceptance and use of technology (UTAUT) and website service quality, compiling it into a usage behavioural model for university library electronic resources.

Design/methodology/approach – Using structural equation model technology to verify model fit. Questionnaire surveys are the main research methodology in this study, in which fourth-year university students and second-year Master's students in six Taiwan public and private universities are the research population. This study uses a cluster sampling, releasing 1,206 questionnaires, and retrieves 1,089 valid questionnaires, for a valid retrieval rate of 90.3 per cent.

Findings – The conclusions are: this study has good fit in the model, and is applicable for the UTAUT; the pairs of variables are correlated; public or private and school type have partial significant mediating effect; website service quality has a significant positive influence on behavioural intention; performance expectancy and social influence both positively affect behavioural intention; facilitating conditions positively affect use behaviour.

Originality/value – Empirical research results and suggestions are provided for the relevant departments for practice and future academic research.

Keywords Unified theory of acceptance and use of technology (UTAUT),
University library electronic resources, Usage behavioural model, Website service quality

Paper type Research paper

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Introduction

The advent of the digital age has made the Internet and electronic information indispensable in life all over the world. Developments in information technology have

converted library archives from paper and physical resources into the digitally archived electronic resources available in today's world. Rapid development in technology has led to close connections between libraries and the Internet, and there has been an increase in electronic resource archives and funding at university libraries in Taiwan, which shows that electronic resources and cloud book repositories have become increasingly important. Cloud book repositories have become crucial development objectives for libraries in the future. The age of digital archive mobile libraries has arrived, and university libraries in Taiwan are actively developing cloud databases. As electronic materials in digital archives have increased, librarians should strive to understand and explore electronic resource usage conditions and satisfaction, as well as the effects of website service quality and behavioural intention and their correlations. This information can be used to construct a usage model for university library electronic resources, which is provided for university library electronic resources decision-making and service departments as a reference for policy, usage and service quality elevation, in turn enhancing the usage benefits of university library electronic resources.

The unified theory of acceptance and use of technology (UTAUT) is a newer theoretical model than the technology acceptance model (TAM), and can strengthen the inadequacies of the TAM. At the current time, domestic and foreign articles primarily focus on Internet banking use behaviour, cloud computing, m-learning, e-commerce, e-service, online purchasing behaviour, behaviour of wiki users, information kiosks, cloud service, mobile banking, social networking sites and mobile newspapers (Abushanab and Pearson, 2007; Behrend *et al.*, 2011; Chandhok and Babbar, 2011; DeLone and McLean, 2004; Hsiao and Lin, 2009; Martín and Herrero, 2012; Shu and Chuang, 2009; Wang and Shih, 2009; Wang *et al.*, 2013; Wu *et al.*, 2013; Zhou *et al.*, 2010). In addition, especially in the electronic environment of digital libraries, e-services play important roles. Parasuraman *et al.* (2005) proposed that the measurement of e-service quality should include efficiency, fulfilment, system reliability and privacy in the electronic service quality scale. Few domestic and foreign studies have connected the "website service quality" of university library electronic resources with the "unified theory of acceptance and use of technology (UTAUT)" and "user behaviour". Therefore, it is necessary and important to explore an integrated model of the "website service quality" and "use behaviour" for university library electronic resources and verify the influence and predictive ability.

This study uses the attributes of research subjects in universities in Taiwan to convert factors influencing behavioural intention in empirical literature into background variables of university students such as gender, class, public or private and school type, which have mediating effects of "performance expectancy", "effort expectancy", "social influence" and "facilitating conditions" on "behavioural intention" and "use behaviour".

In summary, the research background, motives and purposes of this study are:

- to understand the Internet and library electronic resource usage conditions of university students;
- to construct a "use behaviour" model for university students for library electronic resources;
- to explore the correlations among variables in the "use behaviour" of university library electronic resources;

- to verify the influence of "website service quality" on the "behavioural intention" of university library electronic resources;
- to confirm the fit and prediction effect of university library electronic resources in the UTAUT; and
- to explore the mediating effect of different background variables, such as gender, on variables in "performance expectancy", "effort expectancy", "social influence" and "facilitating conditions" on "behavioural intention" and "use behaviour".

Literature review

Electronic resources

Electronic resources are also known as electronic information, electronic collections, electronic publications, digital resources, digital collections or digital resources, which is information conveyed through interfaces such as computers and the Internet (Chang, 2006, 2012; Knight, 2013; Sharma *et al.*, 2011; Zhang *et al.*, 2011). Although different countries have different names and definitions for electronic resources, the content is generally similar. With the progression of the times and development of information technology, the main developments in the past two decades can generally be divided into the five trends of: Internet, digitization, Google, Web 2.0 and mobile phones (Huang and Chen, 2010; Wang, 2010).

In summary of the above research literature, for the study's definition of university library electronic resources, university libraries refer to the libraries of general universities, science and technology universities and general professional universities. This study defines electronic resources not only as the electronic publications from the publishing market, but also as the Internet resources that can be obtained online. The dimensions for measuring electronic resources include the amount of Chinese and Western electronic resources, the types of Chinese and Western electronic resources, classification forms and electronic resource usage (connection, browse, search). The higher scores on the questionnaire mean greater satisfaction.

Unified theory of acceptance and use of technology

In the literature on information technology and Internet application acceptance behaviour, the most well-known and well-discussed is the TAM proposed by Davis (1989). The TAM adopted the theory of reasoned action (TRA) proposed by Fishbein and Ajzen (1975). Venkatesh *et al.* (2003) focused on research over the years for an overview, finding that proven models are unique and have explanatory power in individual fields. Thus, they integrated the eight most important theoretical models from the past: theory of reasoned action (TRA); technology acceptance model (TAM); motivational model (MM); theory of planned behaviour (TPB); combined TAM and TPB (C-TAM-TPB); model of PC utilization (MPCU); innovation diffusion theory (IDT); and social cognitive theory (SCT) (Compeau and Higgins, 1995), and proposed the new framework of "unified theory of acceptance and use of technology" (UTAUT). UTAUT includes the four dimensions of performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitating conditions (FC). PE, EE and SI are the main factors that influence information technology behavioural intention. "Behavioural intention" and FC affect the actual use of information technology. These four dimensions are also affected by the four moderating variables of gender, age, experience and voluntariness of use, as shown in Figure 1.

This study uses the model in Figure 1 as the basis, adding the "website service quality" to integrate the hypothetical model framework for the study. This study uses the "unified theory of acceptance and use of technology " (UTAUT) by Venkatesh *et al.* (2003) as the model framework, with the dimensions of "performance expectancy", "effort expectancy", "social influence" and "facilitating conditions" which influence the dimensions "behavioural intention" and "use behaviour" and added "website service quality".

Website service quality

In regards to service quality, scholars widely utilize the SERVQUAL scale by Parasuraman *et al.* (1988) used to measure service quality. Scholars believe that service quality arises from the gap between the service expected by customers and the services they perceive. The SERVQUAL scale provides practical service quality measurement methods, adding the applicability of service quality measurement, so it is widely used in various sectors. Many studies explore the dimensions of information system service quality including: tangibility, reliability, responsiveness, security, assurance, empathy and website design (Chen and Liu, 2010). Cook and Heath (2002) focused on library service quality for a research project. It used SERVQUAL as the basis to develop 22 core questions, including the three issues of affect of service, information control and library as place. The main issues in the service influence dimensions include:

- librarian dimension;
- information control dimension; and
- library environment dimension.

This study uses reader usage (satisfaction) conditions, exploring the perspectives of the "website service quality" and "use behaviour", in turn, constructing the university library electronic resources "use behaviour" model. The research variable of digital "website service quality" at university libraries utilize the service quality measurement indicators developed by Parasuraman *et al.* (1988), LibQUAL+® developed by the Association of Research Libraries and the library digital service quality dimensions developed by Hernon and Calvert (2005). The items are also modified according to relevant literature and empirical research results. This study divides library digital "website service quality" into "website system", "software and hardware", "professional service" and "library resources".

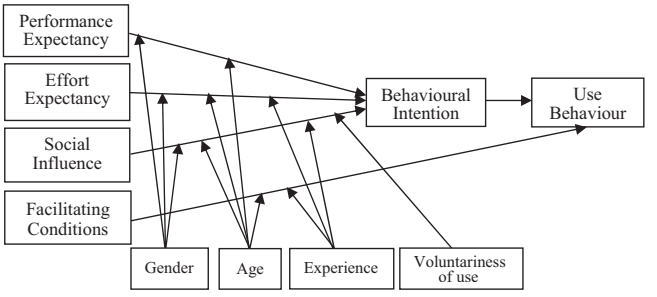

Figure 1.
Unified theory of acceptance and use of technology

Methodology

Research framework and hypotheses

Using the literature review, the authors developed the study framework as shown in Figure 2.

Based on the research purposes, literature review and initial exploration of the research problem, this study proposes the following research hypotheses:

H1. Model expected covariance matrix does not differ from sample covariance matrix.

H2. University library electronic resources variables "performance expectancy", "effort expectancy", "social influence", "website service quality", "facilitating conditions", "behavioural intention" and "use behaviour" have correlation in pairs.

H3. "Website service quality" of university library electronic resources has a significant effect on "behavioural intention".

H4. "Performance expectancy" of university library electronic resources has a significant effect on "behavioural intention".

H5. "Effort expectancy" of university library electronic resources has a significant effect on "behavioural intention".

H6. "Social influence" of university library electronic resources has a significant effect on "behavioural intention".

H7. "Behavioural intention" of university library electronic resources has a significant effect on "use behaviour".

H8. "Facilitating conditions" of university library electronic resources has a significant effect on "use behaviour".

H9. "Performance expectancy", "effort expectancy", "social influence", "website service quality" and "facilitating conditions" of university library electronic resources can effectively predict "behavioural intention" and "use behaviour".

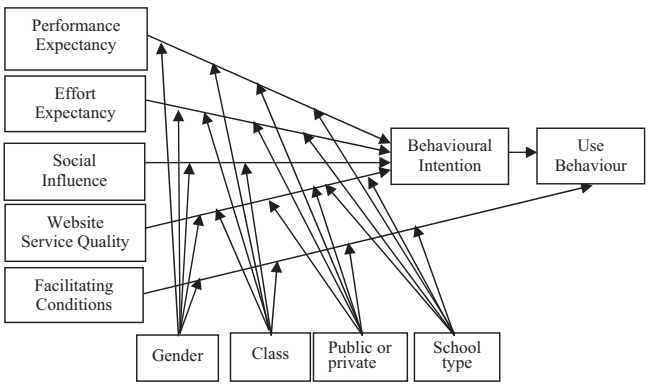

Figure 2.
Research framework

H10. Different background variables have significant moderating effects on the variables of "performance expectancy", "effort expectancy", "social influence" and "facilitating conditions" on "behavioural intention" and "use behaviour".

Research design, subjects and participants

This study used six public and private universities in Kaohsiung City of Taiwan as the research population. Stratified cluster random sampling is used to first identify 8,766 fourth-year university students and 2,734 second-year Master's students, for a total of 11,500 students. For each university, divisions are used as units, extracting two departments from each division. For 29 divisions, 58 departments are extracted. For these subjects, 10 per cent are sampled according to the ratio, 696 are men and 510 are women, for a total sample of 1,206 students.

Research tools

The scale in this study includes basic data, UTAUT, website service quality, behavioural intention and use behaviour. As well as, gender, school, public or private, division and class, basic data also include frequency for using computers or the Internet, activities frequently conducted online, known electronic resources, knowing about the sources of library electronic resources and knowing how to set communication protocols. The unified theory of acceptance and use of technology scale refers to the UTAUT theory and scale proposed by Venkatesh *et al.* (2003). After filtering and revision, the scale items formed for this study are divided into the four measurement dimensions of "performance expectancy", "effort expectancy", "social influence" and "facilitating conditions". Electronic resources "website service quality" scale refers to the studies by Parasuraman *et al.* (1988) and Hernon and Calvert (2005) on e-service quality, then referring to Parasuraman, Zeithaml and Berry (PZB) SERVQUAL theoretical basis for modifications to form the "website service quality" scale in this study. The dimensions are the "website system", "software and hardware", "professional efficacy" and "library resources". The scales for "behavioural intention" and "use behaviour" refer to the "behavioural intention" and "use behaviour" scales by Premkumara and Bhattacherjee (2008) and Hsu and Lin (2008). After composite revision, this study constructs the "use behaviour" scale. There are seven items in the questionnaire scale based on question characteristics, which use a 7-point Likert scale, divided into satisfaction and agreement, with scores from 1 to 7, which represent the range from highly satisfied to highly dissatisfied, respectively.

After the questionnaire design was completed, six Taiwanese experts and scholars on university technology education, digital learning, human resources, knowledge management and library electronic resources tested the questionnaire scale validity. The six experts passed the consistency testing, which means that the scale has good internal consistency. In October 2011, Kaohsiung University (KU) general university and Shu Te (ST) technical university students underwent the pretest; 270 questionnaires were released and 234 valid questionnaires were retrieved. The retrieved samples underwent item analysis (deleting Q28 and Q44) and, after factor analysis, ten factors were derived, which were named PE, EE, SI, FC, behavioural intention and use behaviour. The website service quality dimension was divided into the four dimensions of the website system, software and hardware, professional efficacy and library resources. The Cronbach's α coefficient was used to test for internal consistency among

factors in the scale. The Cronbach's α value of subscales ranged from 0.877 to 0.930, and the value for the overall scale was 0.940, which showed that the whole scale has internal consistency. After these steps, there were 59 items in the questionnaire.

Results and discussions

Descriptive statistical analysis

The study retrieved a total of 1,143 questionnaires. After initial filtering, there were 819 valid questionnaires from fourth-year university students and 270 valid questionnaires from second-year Master's students, for a total of 1,089 valid questionnaires (624 men, 465 women). There were 819 fourth-year university students (75.1 per cent) and 270 second year Master's students (24.9 per cent). The largest group was comprised of 377 who use computers for 3-5 hours a day (34.6 per cent) and the smallest group, 48, use it less than one hour (4.4 per cent). Their most common online activities are social activities (e-mail, MSN, Facebook, Plurk, Skype and so forth) by 919 (84.4 per cent) as the largest group in contrast to the lowest group 464 (42.6 per cent) who use it for research needs. Another group of 742 (68.1 per cent) respondents use the Internet for academic learning (68.1 per cent). These results show that most students still use the Internet for socializing and entertainment, while less than half use it for research. Another group, 523 (48.0 per cent), know about library electronic resources from library promotions, followed by sources such as the Internet and introduction by teachers or students.

Multivariate normal distribution, extreme values and test of offending estimates

Retrieved samples from this study show that the minimum value for each question is 1 and the maximum value is 7. Variance is in the range of 1.117-2.009. The absolute values for skew are in the range of 0.117-0.58 and kurtosis values are in the range of 0.011-0.611, conforming to the proposition by Kline (2005) that in the single variance normal standard, the absolute values of skew should be under 2 and absolute values of kurtosis should be under 7. All the error variance values in this study are positive, and are all significant, which means that error variances exist. Regression estimation values do not exceed 0.95 or 1. The standard errors are not excessive and conform to the suggestions by scholars (Hair *et al.*, 1998; Chen and Wang, 2010). Thus, there are no offending estimates in this research model.

Confirmatory factor analysis

First- and second-order confirmatory factor analysis of dimensions in "website service quality". To ensure that it is legitimate and necessary to deconstruct "website service quality" into four dimensions, single-factor confirmatory factor analysis (CFA), first-order uncorrelated CFA, first-order complete correlation CFA and second-order CFA estimation were conducted to ascertain whether the model could be simplified from a first-order model to a second-order model (Jöreskog and Sörbom, 1996; Doll *et al.*, 1994). First, loading, composite reliability (CR) value, squared multiple correlation (SMC) and average variance extracted (AVE) values (deleting a total of six questions) were used to establish items in the dimensions, then the model fit was used as the model consideration standard. The four dimensions of service quality second order were used to execute second-order CFA, resulting in standardized coefficients in dimensions of 0.858, 0.866, 0.833 and 0.906, all of which were over 0.7 and under 0.95, with positive and significant residual values, without offending estimates. CR is 0.934, over the standard of 0.7. AVE value is 0.780, conforming the standard of greater than 0.5 as suggested by

scholars. SMC values are 0.736, 0.749, 0.694 and 0.820, all of which were greater than 0.5. Ratio of chi-square value and degrees of freedom is 3.625, model goodness of fit index (GFI) and adjusted goodness of fit index (AGFI) values were 0.954 and 0.939, both are greater than 0.9, root mean square error of approximation (RMSEA) is 0.049 and smaller than 0.05, model fit is in the acceptable range. The second-order CFA fit index of website service quality, shown in Table I, that the second order factor model fit is lowest in the 3.625 value of ratio between chi-square value and degrees of freedom. Even though chi-square value is lower at 411.911 of first-order five-factor model, there are no differences in $\triangle$CFI, which shows that there were no actual differences between Model 3 and Model 4, thus in this study, the second-order service quality dimensions do conform to the requirements of the theoretical model.

First- and second-order CFA of "unified theory of acceptance and use of technology". The dimension items are established based on loading, CR values, SMC and AVE values (two items are deleted), then the model fit is used as the model consideration standard. Ratio between chi-square value and degrees of freedom is 6.288, greater than 5, the model fit index GFI is 0.880, smaller than 0.9 and the adjusted model fit index AGFI is 0.849, also 0.9, but RMSEA is 0.07, smaller than 0.08 and not ideal; the reason for the poor fit may be because the residue is not independent. From the modification index covariance output from an structural equation modelling (SEM) analysis, to find correlation between residual number 16 (e16) with higher residual chi-square value covariance and "performance expectancy" and residual number 28 (e28) with "use behaviour", connect the two correlations. At least the model's chi-square value can be lowered to 131.352 and 130.665. Low chi-square values mean good model fit, unstandardized covariance at least increase by 0.189 and 0.211. Evaluation of the chi-square values of e16 and e28 are greater than other variables, so e16 and e28 (Facilitating Conditions 4 (FC4) and User Behavior 4 (UB4) items) are deleted for re-analysis. After deleting FC4 and UB4 items, the ratio of chi-square value and degrees of freedom is 4.511, GFI is 0.918, greater 0.9, AGFI is 0.894, close to 0.9, RMSEA is 0.057, smaller than 0.08, so the fit is in an acceptable range.

Bollen two-stage test

The Bollen two-stage test shows that the chi-square value is 1,350.739, degrees of freedom is 535, ratio of chi-square value and degrees of freedom is 2.525, GFI is 0.866, AGFI is 0.842, RMSEA is 0.053, which generally meet fit standards. The correlation coefficients of the exogamous latent variables are 0.527 to 0.812, most have middle to

Website service quality second order confirmatory factor model	χ^2 value	Degrees of freedom (df)	χ^2/df	GFI	AGFI	CFI	RMSEA
1. First-order single-factor analysis	2,586.987	119	21.739	0.732	0.656	0.822	0.138
2. First-order four-factor model (no correlated factors)	2,906.218	119	24.422	0.733	0.656	0.799	0.147
3. First-order five-factor model (complete correlation)	411.911	113	3.645	0.955	0.939	0.978	0.049
4. Second-order factor model	416.869	115	3.625	0.954	0.939	0.978	0.049
Suggested values	Smaller the better	Greater the better	< 5	> 0.8	> 0.8	> 0.9	< 0.08

Table I. Second-order CF model fit indices for website service quality

high correlation, which means that this study has no collinearity. All error variances are positive, with no negative values. The error variances are all significant, which means that each error variance exists. Regression estimation does not exceed 0.95 or 1. The standard errors are not excessive (Bollen, 1989), so the model in this study has no offending estimates.

Convergent validity and discriminant validity

The CR values of seven dimensions of this model are in the range 0.779 to 0.941, the AVE ranges from 0.528 to 0.799, factor loading are all greater than the standard of 0.7 and the SMC is also greater than 0.5, which conforms to the standards suggested by Fornell and Larcker (1981) and Hair *et al.* (1998), and demonstrates good convergence validity. Using the method of AVE, as shown in Table II, the square roots of AVE in various dimensions are 0.853, 0.829, 0.742, 0.727, 0.894, 0.821 and 0.795, which are greater than the standardized correlations among other dimensions, which conforms to the standard suggested by scholars (Fornell and Larcker, 1981), thus the model in this study has discriminant validity.

SEM structural model evaluation

Model evaluation and Bollen and Stine p correction. In this study, SEM evaluation refers to the indices suggested by Schreiber (2008) and Jackson *et al.* (2009). The study results show that most indices conform to standards, but the p value of the model is 0.000 and significant, thus H_0 is rejected, meaning that the model is not fit. The main reasons causing significant p values are an excessively large sample or real poor fit. There are 541 samples in this study, and empirical experience shows that excessively large samples tend to cause large chi-square values (χ^2 = (n-1) Fmin), thus the bootstrap method proposed by Bollen and Stine (1992) is used to modify the p value to verify whether large chi-square values are because of large samples or poor model fit, as a referential basis for subsequent analysis of the overall model. The Bollen and Stine p correction analysed chi-square value is 747.032, and the original maximum likelihood (ML) chi-square value is 1,831.063. After the Bollen and Stine calculation and modification, the chi-square value became smaller, and all the fit indices are re-calculated (Table III). The results show that all indices (other than close standardized root mean square residual [SRMR]) conform to the principles of general analysis. Therefore, the reason for excessively high chi-square value is the large sample size, but the model fit of this study is still good.

Dimension	PE	EE	SI	FC	WSQ	BI	UB
Performance expectancy (PE)	**0.853**						
Effort expectancy (EE)	0.572**	**0.829**					
Social influence (SI)	0.516**	0.473**	**0.742**				
Facilitating conditions (FC)	0.634**	0.692**	0.609**	**0.727**			
Website service quality (WSQ)	0.589**	0.661**	0.550**	0.709**	**0.894**		
Behavioural intention (BI)	0.668**	0.603**	0.539**	0.688**	0.739**	**0.821**	
Use behaviour (UB)	0.614**	0.540**	0.547**	0.622**	0.639**	0.643**	**0.795**

Table II.
AVE discriminant validity analysis

Note: $^{**}p < 0.01$, average variance extracted (square root of AVE) on the diagonal lines, and below the diagonal lines are correlation coefficients

Fit index	Ideal requirement standard	Reach model	Fit conditions
χ^2	Smaller the better	747.032(p = 0.000)	
χ^2/df	Smaller than 3	1.38	Fit
GFI	Greater than 0.9	0.95	Fit
AGFI	Greater than 0.9	0.95	Fit
RMSEA	Smaller than.08	0.003	Fit
SRMR	Smaller than.05	0.054	Close
TLI(NNFI)	Greater than.9	0.99	Fit
IFI	Greater than.9	0.99	Fit
CFI	Greater than.9	0.99	Fit
Hoelter's	Greater than 200	392	Fit
ECVI	Smaller the better	2.333	Fit
AIC	Smaller the better	923.03	
BIC	Smaller the better	1,300.85	

Notes: TLI(NNFI), Tacker-lewis index(non-normed fit index); IFI, incremental fit index; ECVI, expected cross-validation index; AIC, akaike information criterion; BIC, bayesian information criterion

Table III.
Model fit indices after Bollen and Stine correction

Model cross-validation

To prevent the model from producing random probability errors (Bentler and Bonett, 1980; Cliff, 1983; Cudeck and Browne, 1983), this study takes random distribution of the 1,089 samples at 50 per cent, dividing them into two sample groups with 541 and 548. The first sample group underwent CFA; the second sample group underwent model cross-validation for comparison. The randomly divided two groups are compared: the factor loadings of the two groups are first set to equal, the structural model has 28 factor loadings set to the same (df = 27), chi-square value (CMIN) increases to 29.881, the test results are p = 0.320, which does not reach the 0.05 level of significance, which means that it is acceptable for these 27 factor loadings to be set to the same; other than maintaining the restrictions of the measurement model, nine structural path coefficient settings are added (df = 36−27 = 9), chi-square value (CMIN) increases 37.902 (CMIN = 37.902−29.881 = 8.021), test results p = 0.383, and does not reach the 0.05 level of significance, which means that it is acceptable for these nine structure path coefficients to be set to equal; other than maintaining the restrictions of the measurement model, 15 variance and covariance settings are added (df = 51−36 = 15), chi-square value (CMIN) adds 22.361 (CMIN = 60.263−37.902 = 22.361), test results p = 0.176, and does not reach the 0.05 level of significance, which means that it is acceptable for these 15 variance and covariance to be set to the same, thus all the 15 variance and covariance are equal (Chang, 2011). These conform to the moderate test proposed by Byrne (2010), because if the group equivalency comparison achieves the moderate test, the two groups can be deemed equivalent. The model is stable and conforms to the standards for cross-validation, as shown in Table IV.

There are 1,089 samples in this study, far greater than the minimum sample requirement, conforming to the standards of experience principles, with a tested statistical power of 1, leading to high confidence in the accuracy of results in this study.

Multiple group structural equation models

This study constructs gender, public or private and school type into whole sample and individual attribute samples for structural equation model, to gradually verify whether the chi-square values ($\Delta\chi^2$) of the default model and moderator model are significant and to test the changes in path coefficients under the moderating effects. Based on the moderating effects of attributes of Taiwanese students, such as gender, class, public or private and school type on the multiple group structural equation model, the analytical results show that gender and class do not have a significant moderating effect in the various dimensions. Public or private structures have significant moderating influence in the "performance expectancy", "website service quality" and "facilitating conditions". School type has a significant moderating influence in "facilitating conditions", and no significant moderating influence in the other dimensions, which verifies the results of relevant empirical studies that different academic backgrounds produce differences in the usage of university libraries' websites (Hsieh *et al.*, 2009).

Total effect, direct effect and indirect effect

In this study, usage "performance expectancy" has a direct (total) effect of 0.292 on "behavioural intention", a total effect of 0.121 on "use behaviour". The direct (total) effect of "social influence" on "behavioural intention" is 0.077, and the total effect on "use behaviour" is 0.032. The direct (total) effect of "facilitating conditions" on "behavioural intention" is 0.384. The direct (total) effect of "website service quality" on "use behaviour" is 0.586, while the total effect on "use behaviour" is 0.243. The total effect of "use behaviour" is 0.415, direct effect is 0.415, indirect effect is 0, the total effect = direct + indirect (effect) = 0.415 + 0 = 0.415.

Empirical research shows that *H1*, *H2*, *H3*, *H5*, *H6*, *H7* and *H8* are established, *H9* and *H10* are partially established and *H4* is not established; research hypotheses confirmation results are compiled in Table V.

In sum, the model constructed in this study is shown in Figure 3.

Conclusions and suggestions

Results of this study show that "website service quality" has a significant effect on "behavioural intention", and that "website service quality" can effectively explain the "behavioural intention" and "use behaviour" of electronic resources. Empirical results of this study confirm that the "unified theory of acceptance and use of technology" (UTAUT) model by Venkatesh *et al.* (2003) is still valid for "use behaviour" for university library electronic resources in Kaohsiung, Taiwan. "Performance expectancy", "social influence", "website service quality" and "facilitating conditions"

Table IV. Comparison of group invariance in usage behavioural model for university library electronic resources

Model	χ^2	df	Δdf	$\Delta\chi^2$	p	CFI	Δ TLI	RM-SEA	p close fit
Unconstrained	3,036.840	1,218	–	–	0.000	0.946		0.037	0.990
Measurement weights	3,066.721	1,245	27	29.881	0.320	0.946	−0.001	0.037	0.993
Structural weights	3,074.742	1,254	9	8.021	0.383	0.946	−0.002	0.037	0.985
Structural covariance	3,097.103	1,269	15	22.361	0.176	0.946	−0.002	0.036	0.991
Structural residuals	3,108.638	1,275	6	11.535	0.090	0.946	−0.002	0.036	0.980
Measurement residuals	3,166.607	1,312	37	57.969	0.009	0.945	−0.003	0.036	0.989

Research hypothesis	Hypothesis	Confirmation
H1	University library electronic resources model expected covariance matrix does not differ from sample covariance matrix	Established
H2	University library electronic resources variables "performance expectancy", "effort expectancy", "social influence", "website service quality", "facilitating conditions", "behavioural intention" and "use behaviour" have correlation in pairs	Established
H3	"Performance expectancy" of university library electronic resources has a significant effect on "behavioural intention"	Established
H4	"Effort expectancy" of university library electronic resources has a significant effect on "behavioural intention"	Not established
H5	"Social influence" of university library electronic resources has a significant effect on "behavioural intention"	Established
H6	"Behavioural intention" of university library electronic resources has a significant effect on "use behaviour"	Established
H7	"Facilitating conditions" of university library electronic resources has a significant effect on "use behaviour"	Established
H8	"Website service quality" of university library electronic resources has a significant effect on "behavioural intention"	Established
H9	"Performance expectancy", "effort expectancy", "social influence", "website service quality" and "facilitating conditions" of university library electronic resources can effectively predict "behavioural intention" and "use behaviour"	Partially established
H10	Different background variables have significant moderating effects in the variables of "performance expectancy", "effort expectancy", "social influence" and "facilitating conditions" on "behavioural intention" and "use behaviour"	Partially established

Table V.
Compilation of confirmation results from research hypotheses

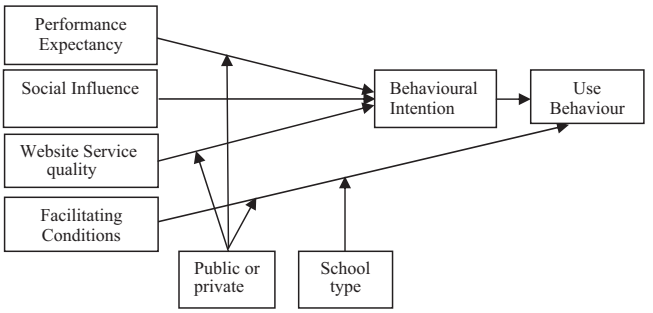

Figure 3.
The model constructed in this study

can effectively predict the "behavioural intention" and "use behaviour". "Facilitating conditions" and "use behaviour" both have predictive effects. The background variables of public or private and school type in variables such as "performance expectancy", "effort expectancy", "social influence" and "facilitating conditions" have partial significant moderating effects on the "behavioural intention" and "use behaviour". Gender and class background variables do not have moderating effects on various dimensions. The research findings and conclusions of this study show that this study

differs from "unified theory of acceptance and use of technology" in that: "effort expectancy" does not have a significant influence in this study; "website service quality" added by this study has a significant influence; gender and class in variables of "performance expectancy" do not moderate the influence on "behavioural intention"; public or private has an moderating effect in "performance expectancy" and "website service quality" on "behavioural intention"; and school type has a moderating effect in the effect of "facilitating conditions" on "use behaviour".

Academic and management implication

Empirical research from the literature and this study show similar results to the "unified theory of acceptance and use of technology" (UTAUT) by Venkatesh *et al.* (2003). The results show that the model has good fit, making it usable as a reference for future academic research and management practice. The model can also be used as a reference for developmental policies and directions for electronic resources from the school library. Libraries need to accommodate advancement of the times, integrating Web 2.0 and advanced techniques, conforming to the upgrading of Library 2.0, in hopes of truly satisfying user needs. "Website service quality" is an important indicator affecting library websites, thus universities should work on this aspect to effectively enhance student "use behaviour" in library electronic resources.

Suggestions

Suggestions for schools, students and system vendors. Schools should focus on student needs to continuously improve various website systems, software and hardware equipment and electronic resource archives to create a good environment for university library electronic resources. It is also necessary to enhance personnel service attitude and quality, in hopes of satisfying the needs of students in different fields. Students should fully utilize electronic resources at the school library to maximize their benefits. If they find that the interface is too complex and difficult to operate or when the feedback mechanism is not as expected or they have other problems about library electronic resources, they should respond to the e-mail address or communication platform established by the school, so that the problems can be improved. System vendors should focus on user-centred library electronic resources website design to conform to user needs. If it is possible to conduct regular monitoring, timely evaluation and adjustment feedback of search amount, download amount and speed, these can serve as important referential foundations for the revision, research and development of the future website systems.

Suggestions for future studies. The results can be expanded to focussing on students of other years, teachers and administrative staff, and users of other libraries or museums in different professional fields. It is also possible to expand research sampling to schools in northern, central and eastern Taiwan, or in remote areas, to enhance the research breadth and depth to make the results more generalizable. In addition, the incorporation of different factors (age, college division, education, usage experience and whether subjects easily accept new technological products) and different variables (students' personal traits, user attitudes, user involvement, education and training and self-efficacy) would be helpful to explore the difference and extent to which they influence the "use behaviour" model.

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